THE RELATIONSHIP BETWEEN SALIVARY CORTISOL LEVELS AND SELF-PERCEPTION OF ANXIETY IN ADULTS WHO STUTTER ACROSS VARIOUS SPEAKING SITUATIONS

A thesis

submitted in partial fulfillment

of the requirements for the Degree

of

Master of Science in Speech and Language Sciences

in the

Department of Communication Disorders

by

Janine Diehl

University of Canterbury

2011

Contents

Appendix F Procedures for the Analysis and Determination of Cortisol143

List of Figures

List of Tables

Acknowledgements

This study was only possible because I was very much supported by many professionals. First of all, I would like to express my sincere appreciation to my principal supervisor, Professor Michael Robb, for his enthusiasm, his encouragement and guidance through the whole study. I would also like to thank him for allowing implementing my own ideas, for the much-appreciated creative and stimulating discussions about fluency disorders, for recruiting participants and a control group, for giving lots and lots of feedback and for his strength of purpose to stay focused on the overall structure throughout the completion of this thesis. In addition, I would like to thank my co-supervisor, Mrs. Tika Ormond, for her advice and suggestions in the initial stages of planning this research, as well as her assistance in recruiting stuttering participants. Many thanks also to Dr. Emily Lin for her advice and enormous support with the statistical analysis of my data. Furthermore, I would like to extend my gratitude to Dr. John Lewis of the Canterbury Health Laboratories, whose efforts analysing the salivary cortisol samples, I could not have completed this research without. On behalf all the participants of this study, I would like to express my sincere appreciation, who would commit themselves coming in the Clinics of the Department of Communication Disorders five days over a one-week period and having interesting discussions about stuttering. Thanks to my flat mates and friends Nicola McDonald and Lindsey Underwood for all their loving support throughout the year. Last but not least, I would like to extend my thanks to Tze-Peng Wong, Phd, and Martina Schäfer, Phd, for not only providing reliability on my study, but more importantly, for their listening and reassurance. Thanks to my friends back home and my family for all their love, support and belief in me. I could not have done this work without them, thank you so much.

Abstract

Adults who stutter (AWS) are reported to have increased levels of anxiety compared to adults who do not stutter (AWNS), particularly in social interactions (Kraaimaat, Vanryckeyham, & Dan-Baggen, 2002; Mahr & Torosian, 1999; Messenger, Onslow, Packman, & Menzies, 2004). However, the level of perceived anxiety in AWS according to specific speaking situations has not been critically evaluated. In addition, most studies addressing state anxiety (i.e., communication apprehension) are based on self-judgments (Craig, 1990; Craig, Hancook, Tran, & Craig, 2003; Ezrati-Vinacour & Levin, 2004; Gabel, Colcord, & Petrosino, 2002; Lincoln, Onslow, & Menzies, 1996; Messenger et al., 2004; Miller & Watson, 1992; Mulcahy, Hennessey, Beilby, & Byrnes, 2008) which have not been verified using a physiological evaluation of anxiety. The present study sought to examine the relationship between a physiological measure of anxiety (i.e., cortisol) and perceptual judgments of communication apprehension across different speaking situations. Ten AWS aged between 19-62 years, and ten sex- and aged-matched AWNS provided salivary cortisol samples during distinct speaking situations across a one-week period. The speaking situations consisted of (1) speaking face-to-face with a friend, (2) speaking face-to-face with a single stranger, (3) speaking in front of a group of four strangers, and (4) speaking to a stranger on the telephone. Each participant also provided self-perception assessments of their perceived anxiety levels using an adaptation of the Speaking Task Response Scale (STRS; Bray & James, 2009) before and after each speaking situation. Results of the cortisol analysis revealed no statistical difference in cortisol levels across the four speaking situations between AWS and AWNS. A significant difference was found between self-perceived anxiety levels in the pre-speaking situation between AWS and AWNS. Speaking face-to-face with a friend was perceived by the AWS to result in the lowest level of anxiety compared to the remaining three situations. Correlational analyses revealed a significant relationship between cortisol levels and self-reported anxiety in the AWS group but no such relationship was evident for AWNS. On the basis of the combined results from the

cortisol and self-perception analyses it can be concluded that AWS differ from AWNS in their communication apprehension, most notably in regard to speaking in any situation other than a familiar person (e.g., friend). This difference between AWS and AWNS is most evident in measures of self-perception, although it is likely there is an associated physiological contributing factor.

1 Introduction

1.1 Definition of Stuttering

Stuttering is described as unusually frequent speech disruptions which are not experienced by normal speakers, and are probably derived from a motor speech disorder including phoneme, syllable, and word repetitions, phoneme prolongations, airflow and voicing blocks in the flow of speech (Bloodstein & Bernstein Ratner, 2008; Guitar, 2006; Ochsenkühn, Thiel, & Ewerbeck, 2010; Robb, 2010; Starkweather & Givens-Ackerman, 1997; Wendlandt, 2009). There has been no consistent definition of stuttering which identifies all of its symptoms (Bloodstein & Ratner, 2008; Onslow, 1996; Perkins, 2001; Ward, 2006). Wingate (1962) described stuttering as a

> "disruption in the fluency of verbal expression, which is characterized by involuntary, audible or silent, repetitions or prolongations in the utterance of short speech elements, namely: sound, syllable and words of one syllable. The disruptions usually occur frequently or are marked in character and are not readily controllable" (p. 488).

Conture (1990) describes stuttering with certain clinical observation as

> "speech like many other human behaviours, is occasionally produced by speakers with hesitations, interruptions, prolongations, and repetitions. These disruptions in [...] ongoing speech are termed dysfluency and the frequency, duration, type, severity, and so forth of these speech dysfluencies vary greatly from person to person and from speaking situation to speaking situation. Some of these speech dysfluencies, particularly those which involve within-word disruptions (such as sound or syllable repetitions) are most apt to be classified or judged by listeners as stuttering" (p. 2).

Another way to characterise stuttering is to adopt the terminology used in the Lidcombe treatment program (O'Brian, Onslow, Cream, & Packman, 2003; O'Brian, Carey, Onslow, Packman, & Cream, 2009). This terminology divides stuttering behaviours into

three categories: (1) repeated movements (syllable repetitions, incomplete syllable repetitions, and multi-syllable unit repetitions), (2) fixed postures with audible and without audible airflow, and (3) verbal (e.g., starters) and nonverbal (e.g., movements) superfluous behaviours (Packman & Onslow, 1998; Teeson, Packman & Onslow, 2003). Most definitions of stuttering seem vague and indefinite.

Adults who stutter (AWS) also display associated symptoms such as struggle reactions, speaking on inhalation instead, parakinesias, fixations, visible or audible tension in the form of associated physical movements, as well as avoidance behaviour such as substituting words in order to avoid words that may be stuttered upon (Bloodstein & Bernstein Ratner, 2008; Guitar, 2006, Wendlandt, 2009). Further symptoms include facial grimacing, and obvious fear and anxiety during speaking, and anticipation of speech failure prior to speech attempts (Sheehan, 1970). The overt symptoms of stuttering combined with the covert behaviours can contribute to feelings of fear, shame, guilt, anxiety, hopelessness, isolation, and denial as an analogy of stuttering (Sheehan, 1970). A classic way of depicting the overt and covert aspects of stuttering is in the shape of an iceberg (Sheehan, 1970). The tip of the iceberg is formed by the overt audible and visible signs of stuttering that rises above the water level. Nevertheless, a greater and more detrimental impact is the portion that is underwater, which can greatly impact the AWS‘ life1. Beyond these measurable factors, people who stutter often experience psychosocial and emotional issues caused by the overt and covert behaviours of the disorder (Bloodstein & Ratner, 2008; Guitar, 2006; Kaplan, Anderson, & Graniats, 1993; Klein & Hood, 2004; Klompas & Ross, 2004; Robb, 2010; Sheehan, 1970; Yaruss & Quesal, 2004a).

Another way to define and distinguish stuttering from other dysfluencies is to measure features of stuttering, such as the time since onset (symptoms must have lasted longer than six months) and the frequency of dysfluency (more than 3% out of 100 syllables must be stuttered) (Conture & Curlee, 2007; Bloodstein & Ratner, 2008; Ward, 2006).

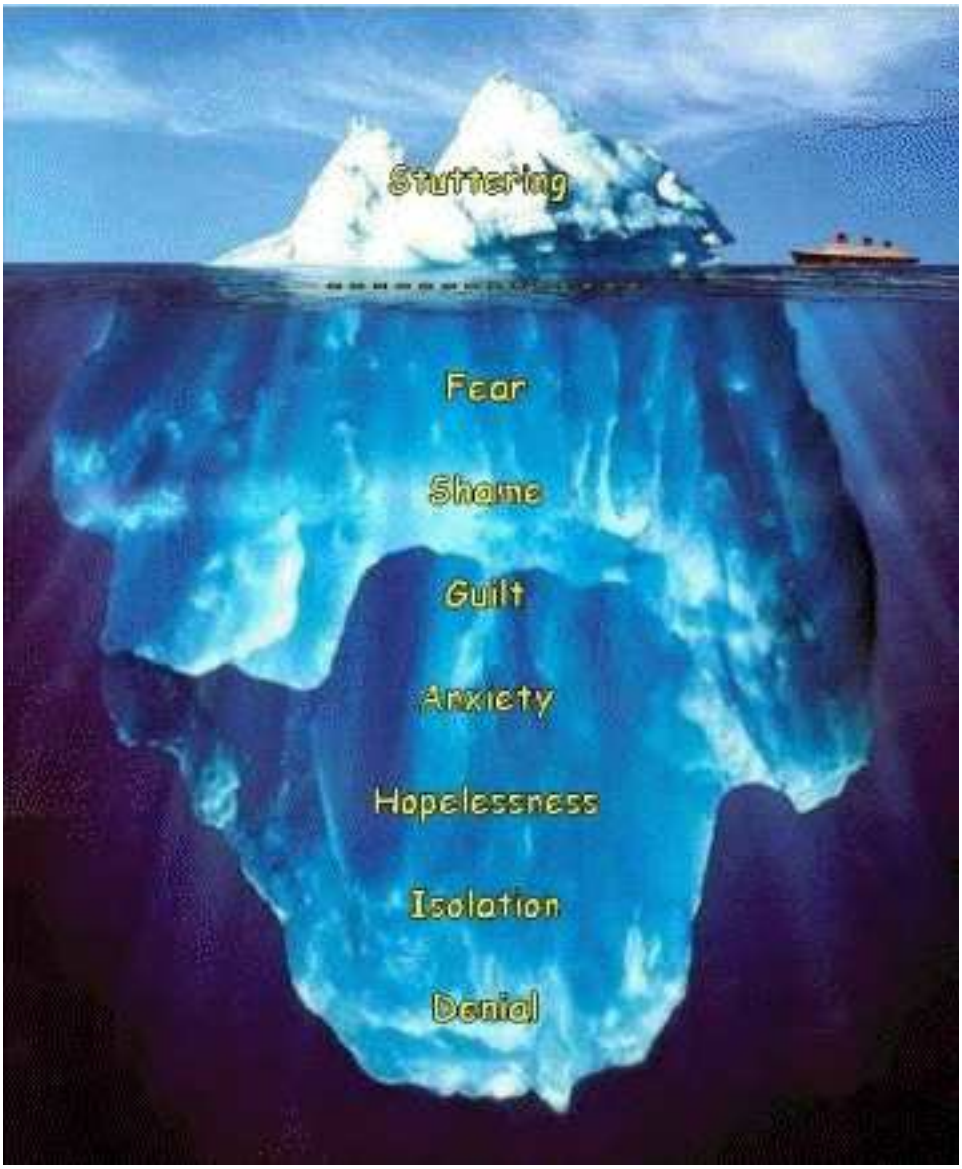


Figure 1: Iceberg analogy of stuttering (Sheehan, 1970). Source: http://www.speechhelper.com/

1.2 Theories of Stuttering

There are a wide variety of theories to describe the etiology and nature of stuttering. One of the classic theories is the Diagnosogenic Theory proposed by Johnson (1942). According to this theory, both children who stutter (CWS) and children who do not stutter (CWNS) exhibit normal speech dysfluencies such as repetitions and prolongations. Johnson believed that the origins of stuttering were triggered by the child's parents' or another close communication partners' misdiagnosis of normal dysfluencies as stuttering. Subsequently as a result of this misdiagnosis, the child becomes more aware of these speech dysfluencies and tries to avoid them, and becomes consequently more anxious about speaking in general (DeNil & Brutten, 1990; Vanryckeghem & Brutten, 1996). Thus, while the original diagnosis of stuttering may have been inaccurate, the misdiagnosis might trigger actual stuttering (Johnson, 1942). This theory has been revised many times, but remains one of the most often cited in stuttering research.

There are different classification systems of theories of stuttering. Most theories can be generally divided into *Breakdown Hypotheses*, *Anticipatory Struggle Theories*, and theories explaining stuttering as an *Instrumental Avoidance Act* (Bloodstein & Bernstein Ratner, 2008). A representation of the Breakdown Hypothesis is the *Demands and Capacities Model (DCM)* by Starkweather, Armson, and Amster (1987). This theory states that "dysfluencies, as well as real stuttering, emerge when a child's capacities for fluency are not equal to speech performance demands" (Guitar, 2006, p. 119). Andrews, Hoddinot, Craig, Howie, Feyer, and Neilson (1983) assert that stuttering develops from a balancing problem between the rapid development of neurological capacity of the brain and the demand of the external environment (such as fast-talking parents). Permanently high demand for perfect speech in combination with very little support from the parents in adapting their speech towards child-directed speech during early stages of language development can result in stuttering (Sheehan, 1970). A particular strength of this theory is the acknowledgement of the variable nature of stuttering in explaining the interference of "speech, language, and motor limitations

and environmental demands to create each individual case of stuttering" (Bloodstein & Bernstein Ratner, 2008, p. 56).

An example of an Anticipatory Struggle Theory is the *Theory of Communicative Pressure* (Bloodstein, 1958, 1975). Bloodstein asserts that stuttering begins as a response of tension and fragmentation in speech and causes the provocation of continued or severe communicative failure in the presence of communication pressure. These frustrating moments are not necessarily dysfluency-specific; they can be caused by any other delays in developmental articulation, language or speech problems. If the child is repeatedly exposed to situations in which he/she is misunderstood or bullied because of poor speech, he/she might begin to tense his/her speech muscles or interrupt their speech. Furthermore, internal and external environmental factors may also compound the impact of these frustrating moments, such as unrealistically high parental standards of speech, speech pressures (e.g., in competition with siblings of higher speech-language development, excessive praise for good speech, or identification with linguistically higher sophisticated adult speakers). Furthermore, certain personality factors and traits (e.g., temperament and ineffective coping strategies) can make a child very vulnerable which can lead to anticipatory struggle behaviour (Bloodstein & Bernstein Ratner, 2008; Guitar, 2006). Perkins, Kent and Curlee (1991) suggested that stuttering occurs when the variables of speech disruption and time pressure come together. This situation results in a loss of control that coincides with the production of dysfluent speech (Perkins et al., 1991).

An example of an Instrumental Avoidance Act is captured by the *Approach-Avoidance Conflict Theory* originally developed by Sheehan (1953, 1958). According to this theory, AWS are caught in an intrinsic struggle between the desire to speak (approach) and the reluctance to be embarrassed by stuttering (avoidance). Consequently, speech anxiety, as well as a lack of ability to resolve the inherent conflict between speaking and remaining silent develops, which leads in the end towards stuttering (Miller, 1944; Sheehan, 1970, 1975). Bloodstein concludes "this clearly suggests that stuttering may have its origin both in the learning of speech anxieties and in unconscious personality

factors" (Bloodstein & Bernstein Ratner, 2008, p. 63). Another study looking at an AWSs' avoidance behaviour is the *Conditioned Disintegration Theory* by Brutten and Shoemaker (1967, 1970). This theory is based on principles of classic conditioning and explains that stuttering occurs as a result of negative reactions by listeners to the speech of a person who shows dysfluencies. This again results consequently in avoiding certain sounds and/or words by the AWS, and can then even contribute to avoiding specific speaking situations depending on apprehension of stuttering severity, which may lead to further dysfluencies and higher anxiety arousals in general (Brutten & Shoemaker, 1967).

1.3 Anxiety and Communication Apprehension in Stuttering

Anxiety is a multidimensional construct which can be divided into three components, (1) verbal-cognitive, (2) behavioral, and (3) physiological (Marks, 1987). Freud (1936) defined anxiety as an emotional state that includes feelings of apprehension, tension, nervousness, and worry often accompanied by physiological arousal.

The verbal-cognitive component refers to self-perceived worry and anxiety based on subjective reports of former or present emotional reactions to different speaking situations or events. The behavioural component is linked to avoidance and/or escape behaviour (e.g., looking away instead of holding eye contact, or avoiding certain difficult speaking situations or persons). The physiological component includes physical reactions of the body such as sweating, blushing, heart rate rising, or cortisol changes. A person who stutters (PWS) may or may not show all three components at once, but often do (Guitar, 2006; Marks, 1987; Menzies, Onslow, & Packman, 1999).

When undertaking research related to anxiety and stuttering it is important to distinguish between anxiety as an emotional transient *state* which is influenced by a condition or situations (e.g., a certain speaking situation), and individual personality *traits* which refer to a person's inherent level of anxiety (e.g., resilience or coping behaviour with difficult situations) (Bennett, 2006; Cattell, 1966; Lincoln, Onslow, & Menzies, 1996). *State anxiety* is a form of anxiety specific to a given situation, and may

be influenced by factors associated with social interaction (Ezrati-Vinacour & Levin, 2004; Spielberger, Gorsuch and Luschene, 1970). In contrast, *trait anxiety* correlates to a general level of anxiety of an individual, and develops gradually over a longer period of time (Ezrati-Vinacour, 2004; Menzies, Onslow, & Packman, 1999).

A specific type of state anxiety which is directly associated with speech is *communication apprehension (CA)* (McCroskey, 1978). CA is a subjective, affective experience (McCroskey & Beatty, 1986), which rises over years, while expecting and experiencing negative feelings associated with communication (Blood, Blood, Tellis, & Gabel, 2001). High CA has been found to negatively affect desirable outcomes in interpersonal relationships, in work environment, and also in educational environment (McCroskey & Beatty, 1986). Another form of state anxiety which often co-occurs in PWS is *social anxiety disorder* and *social phobia*. The term *social anxiety disorder* is commonly more used than *social phobia*, but the two terms are interchangeable. There is a long history in psychiatric literature of case reports of stuttering and social anxiety in PWS (Kraaimaat, Vanryckeghem & Van Dam-Baggen, 2002; Lincoln et al., 1996; Mahr & Torosian, 1999; Stein, Baird, & Walker, 1996). Iverach, O'Brian, Jones, Block, Lincoln, Harrison, Hewat, Menzies, Packman, and Onslow (2009) found after surveying 92 AWS and 920 AWNS that AWS have a 34-fold increased likelihood to be diagnosed with social phobia, generalized anxiety disorder, or panic disorder.

The verbal-cognitive component of trait and state anxiety according to emotions, fears, and anxiety towards stuttering and speaking in general (as well as speaking in specific situations) can be measured by a variety of self-reported questionnaires. A list of these questionnaires can be found in Table 1. Social anxiety can be measured by various questionnaires, as shown in Table 2. In contrast, social phobia is clinically diagnosed categorically with an Axis 1 diagnostic interview or a computerised version of such an interview with some research.

Authors	Questionnaire	Anxiety
Andrews & Cutler (1974)	Erickson Modified 24 Scale	communication apprehension
Bray & James (2009)	Speaking Task Response Scale (STRS)	communication apprehension
Brutten (1973, 1975); Brutten & Janssen (1981)	Speech Situation Checklist (SSC)	communication apprehension, reaction to stuttering and coping behaviours
Clare, Menzies, Onslow, Packman, Thompson, & Block (2009)	Unhelpful thoughts and beliefs about Stuttering Scale (UTBAS)	thoughts and beliefs about stuttering, communication apprehension
Endler, Edwards, & Vitelli (1990)	Endler Multidimensional Anxiety Scale-Trait (EMAS-T)	state and trait anxiety
Heimburg & Becker (2002)	Liebowitz Social Anxiety Scale (LSAS)	primary anxiety and avoidance behaviour
Knower (1938)	Speech Attitude Scale	communication apprehension
McCroskey (1978); McCroskey, Beatty, Kearney, & Plax (1985)	Personal Report of Communication Apprehension (PRCA)	communication apprehension
McCroskey & McCroskey (1988)	Self-Perceived Communication Competence (SPCC)	communication competence and apprehension
McCroskey (1992)	Willingness to Communicate Scale	communication apprehension, avoidance behaviours, frequency of exposure to situations
Schalling, Chronholm, & Asberg (1973)	Multi Component Anxiety Inventory (MCAI-IV)	psychic and cognitive anxiety, and somatic anxiety
Shumak (1955)	Speech Situation Rating Sheet for Stutterers	communication apprehension
Spielberger (1983)	State-Trait Anxiety Inventory (STAI): State Anxiety Inverntory (SAI) & Trait Anxiety Inventory (TAI)	state and trait anxiety
Watson (1987, 1988); Watson, Gregory, & Kistler (1987)	Inventory of Communication Attitudes (ICA)	communication apprehension, coping behaviours in different situations
Wolpe (1990)	Subjective units of distress scale (SUDS)	state anxiety
Yaruss & Quesal (2006)	Overall Assessment of the Speaker‘s Experience of Stuttering (OASES)	communication apprehension, coping behaviours in different situations

Table 1: Examples of self-reported questionnaires measuring trait and state anxiety, and communication apprehension in AWS and AWNS over the last 70 years.

Study	**Questionnaire**	**Anxiety**
Beck, Epstein, Brown, & Steer (1988)	Beck Anxiety Inventory (BAI)	panic disorders
Kraaimaat, Vanryckeghem, & Van Dam-Baggen (2002)	Inventory of Interpersonal Situations (ISS)	social anxiety
Sheehan (1983)	Sheehan Disability Scale	disability and impairment in general
Watson & Friend (1969)	Social Avoidance and Distress Scale (SAD)	Social Anxiety
Watson & Friend (1969)	Fear of Negative Evaluation Scale (FNE)	Social Anxiety
Turner, Beidel, Cooley, Woody, & Messer (1994)	Social Phobia and Anxiety Inventory	social phobia, severity of social anxiety

Table 2: Examples of self-reported questionnaires measuring social anxiety and social phobia in AWS and AWNS over the last 40 years.

A number of studies have been undertaken for the past 40 years examining various aspects of anxiety in PWS. Features of both state and trait anxiety have been considered. A summary of these studies is pictured in Table 3 and 4. Table 3 lists studies that are found based on self-judgments of anxiety. Table 4 lists studies that have involved physiological assessments of anxiety.

Study	Method	Sample Size	Age	Results
Blood, Blood, & Tellis (2001)	*PRCA-24*; *SPCC*	39 adolescent AWS, 39 adolescent AWNS	13-18 years	Higher levels of communication apprehension and poorer scores of self-perceived communication competence in AWS than in AWNS
Blood, Blood, Maloney, Meyer, & Qualls (2007)	Revised Children's Manifest Anxiety Scale; Rosenberg Self-Esteem Scale *(RSES)*	36 adolescent AWS, 36 adolescent AWNS	12-18 years	Difference in trait and state anxiety between AWS and AWNS
Craig (1990)	Telephone call, *STAI*	102 AWS pretreatment, 43 AWS posttreatment, 102 AWNS	M=31.2 years	Higher trait and state anxiety levels in AWS than in AWNS
Craig, Hancock, Tran, & Craig (2003)	Telephone Interview; *TAI*	87 AWS, 4602 AWNS	All age groups	Higher trait anxiety levels in AWS than in AWNS; severe AWS have higher anxiety levels than milder AWS
Davis, Shisca, & Howell (2007)	*STAI* for children	18 persistent adolescent AWS, 17 recovered adolescent AWS, 17 adolescent AWNS	10-17 years	No difference in trait anxiety levels between persistent and recovered AWS and AWNS; higher state anxiety levels in persistent AWS than in recovered AWS and AWNS
De Nil & Brutten (1990)	Communication Attitude Test *(CAT-D)*	70 CWS, 271 CWNS	4-7 years	CWS did not differ from CWNS in speech-associated attitudes
Ezrati-Vinacour & Levin (2004)	*TAI*; *SSC*; Task-Related Anxiety Scale *(TRA)*	47 AWS, 47 AWNS	18-43 years	Higher trait and state anxiety levels in AWS than in AWNS; positive relationships between trait, state anxiety and communication apprehension in AWS

Table 3: Studies in anxiety and stuttering based on self-reported questionnaires in AWS and AWNS over the last 60 years.

Study	Method	Sample Size	Age	Results
Fitzgerald, Djrdjic, & Maguin (1992)	Willoughby Personality Schedule-R	27 AWS	16-40 years	High trait anxiety levels in AWS as a result of hypersensitivity to interpersonal stress
Gabel, Colcord, & Petrosino (2002)	Thought sampling worksheet	10 AWS, 10 AWNS	22-57 years	Higher communication apprehension in different speaking tasks in AWS than in AWNS; no single speech condition differentiated AWS from AWNS
Green (1999)	Comprehensive System for Rorschach Inkblot Test	40 CWS, 60 AWS	8-12 years, 20-56 years	Stuttering severity correlates with participation in social interaction
Kraaimaat, Jannssen, & Van Dam-Baggen (1991)	Social Anxiety Schedule	110 AWS, 110 socially phobic AWNS, 110 AWNS	M=27.9 years	AWS more anxious than AWNS, but significantly less anxious than social phobic patients
Kraaimaat, Vanryckeghem, & Van Dam-Baggen (2002)	*IIS*	89 AWS, 131 AWNS	18-50 years	AWS showed higher levels of emotional tension and discomfort in social situations; AWS showed lower frequency of social responses compared to AWNS
Lerman & Shames (1965)	Discomfort-Relief Quotient *(DRQ)*, Frequency of stuttering, and number of spoken words in interview	22 AWS	16-52 years	No difference in DRQ in 4 speaking situations; no relationship between degree of anxiety & frequency of stuttering
Lincoln, Onslow, & Menzies (1996)	Survey assessing trait and state anxiety	139 clinicians, 174 AWS, 72 AWNS	All age groups	87% of the AWS and 97% of clinicians think there is a difference in state anxiety levels between AWS and AWNS; no differences in trait anxiety levels

continues

Study	**Method**	**Sample Size**	**Age**	**Results**
Mahr & Torosian (1999)	*SAD*, *FNE*, Fear Questionnaire *(FQ)*, Self-Rating Anxiety Scale *(SAS)*	22 AWS, control data from social phobic patients and AWNS	M=38 years	AWS show more often signs of social anxiety and social avoidance behaviours than AWNS, no difference between AWS and social phobia patients in trait anxiety; more speech-related fear in AWS
Messenger, Onslow, Packman, & Menzies (2004)	*FNE, EMAS-T*	34 AWS, 34 AWNS	19-58 years	AWS show higher fear of negative evaluation than AWNS; AWS show higher fear in social interaction and in new or more difficult situations than AWNS; AWS expect social harm
Miller & Watson (1992)	*STAI*, Erickson Modified 24 Scale	52 AWS, 52 AWNS	16-68 years	No higher state and trait anxiety in AWS than in AWNS; higher communication apprehension in AWS linked with stuttering severity
Mulcahy, Hennessey, Beilby, & Byrnes (2008)	*STAI*, *FNE*, *OASES* (Teen Version)	19 adolescent AWS, 18 adolescent AWNS	11-18 years	Higher trait, state and social anxiety in AWS than in AWNS; trait and state anxiety was related to perceived difficulty with functional communication in daily situations
Stein, Baird, & Walker (1996)	diagnostic interviews	16 AWS	M= 35.6 years	12 out of 16 AWS were diagnosed with social phobia when applied to the patient‘s fear of stuttering; according to criteria of social phobia only 7 of the 16 were diagnosed comorbid with social phobia

continued

Study	**Method**	**Sample Size**	**Age**	**Results**
Thomas (2005)	*FNE*, Social Avoidance and Distress Scale	31 AWS, 31 AWNS	18-65 years	AWS showed higher levels of social avoidance, distress and fear of negative evaluation in social contexts than AWNS
Vanryckeghem & Brutten (1996)	Communication Attitude Test *(CAT-D)*	55 CWS, 55 CWNS	M=9.3 years	CWS did not differ from CWNS in speech-associated attitudes; speech-associated attitudes are related to stuttering severity

continued

Study	Method	Sample Size	Age	Results
Baumgartner & Brutten (1983)	Mean heart rate, heart rate variability, Behaviour Assessment Battery (Brutten, 1975)	3 AWS	18-21 years	For 2 of the subjects mean heart rate & heart rate variability were predictive for speech performance; for the third subjective mean heart rate was predictive for speech performance, but heart rate variability was not
Blood, Blood, Bennett, & Simpson (1994)	Cortisol, *STAI*, Personal Report of Communication Apprehension	11 AWS, 11 AWNS	19-36 years	Higher cortisol levels during high stress situation between AWS and AWNS; no differences in trait and state anxiety levels and in communication apprehension between AWS and AWNS
Blood & Blood (1997)	Cortisol, Personal Report of Communication Apprehension	11 AWS, 11 AWNS	18-28 years	No difference in communication apprehension in AWS and AWNS
Caruso, Chodzko-Zajko, Bidinger, & Sommers (1994)	Cardiovascular, behavioral, and acoustic measures	9 AWS, 9 AWNS	16-40 years	No difference in anxiety levels of autonomic arousal when speaking or reading aloud between AWS and AWNS, correlation between stuttering severity and anxiety levels
Dietrich & Roaman (2001)	Skin conduct response, Speech-related anxiety questionnaire	24 AWS	18-71 years	No correlation between AWS communication apprehension and physiological arousal
Gray & Brutten (1964)	Measuring palmar sweat	11 AWS	M=22.7	No relationship between stuttering frequency and anxiety level

Table 4: Studies in stuttering and anxiety measuring physiological levels of anxiety over the last 50 years.

Study	Method	Sample Size	Age	Results
Janssen & Kraaimaat (1980)	Reading task, SSC, skin resistance, heart rate	48 adolescent AWS, 48 adolescent AWNS	13-16 years	AWS did not differ in physiological arousal from AWNS; no difference in communication apprehension in speech testing situation
Kraaimaat, Jannsen, & Brutten (1988)	Heart rate, skin conductance	33 AWS	13-16 years	Correlation between decrease in stuttering moments and physiological measurement
Peters & Hulstijn (1984)	Heart rate, vasomotor response, electrodermal activity; 5-point rating scales	24 AWS, 24 AWNS	18-37 years	No difference in physiological arousal between AWS and AWNS; higher communication apprehension after each task; positive correlation between physiological arousal and stuttering severity
Phaal (2007)	Cortisol, Communication Attitude Test for preschool and kindergarten CWS, Parent Preschool Anxiety Scale	7 CWS, 7 CWNS	3-4 years	No difference in trait anxiety levels and communication apprehension in CWS and CWNS
Weber & Smith (1990)	Skin conductance, peripheral blood flow, heart rate	19 AWS; 19 AWNS	17-68 years	No difference in physiological arousal between AWS and AWNS; positive correlation between physiological arousal and stuttering severity

continued

A considerable amount of studies have shown evidence of a relationship between anxiety and stuttering. In particular, most studies have found that AWS have increased state anxiety levels specific to social interactions compared to AWNS (Craig, 1990; Ezrati-Vinacour & Levin, 2004; Lincoln & Onslow, & Menzies, 1996; Mulcahy, Hennessey, Beilby, & Byrnes, 2008). One of the most often cited studies was completed by Craig (1990) who examined 102 AWS and 102 AWNS with trait and state anxiety measures before and after intensive treatment while making a five minute. telephone call to a stranger. Results showed higher state and trait anxiety levels before treatment for AWS compared to AWNS, but no such differences were found for trait anxiety after treatment. Onslow (1996) questioned the external validity of this study because state anxiety was only measured when speaking on the telephone. There seems to be an agreement among researchers that speaking on the telephone is a highly anxiety-provoking situation (Georgieva, 1994; James, Brumfitt & Cudd., 1999; Kehoe, 1998; Ladoucer, Cote, Leblond & Bouchard, 1982; Leith & Timmons, 1983a & 1983b; Resick, Wendiggensen, Ames & Meyer, 1978; Silverman, 1997; Zimmermann, Kalinowski, Stuart & Rastatter, 1997), which might explain why state anxiety levels in the Craig (1990) were very high before treatment.

Ezrati-Vinacour and Levin (2004) measured trait and state anxiety, as well as communication apprehension with the *STAI* (Spielberger, 1983), the *SSC* (Brutten, 1973, 1975; Brutten & Janssen, 1981; Vanryckeghem, 1995), and the Task-Related Anxiety *(TRA)* rating scale in 47 AWS and 47 AWNS after performing two speech-related tasks and two non-speech tasks: (1) Talking about personal information, (2) Reading aloud, (3) Reading silent, and (4) Listening to a recorded passage. Results indicated higher trait anxiety levels in AWS compared to AWNS. Moreover, Ezrati-Vinacour found that state anxiety (i.e., communication apprehension) is higher among severe AWS compared to mild AWS and AWNS. Thus, state anxiety (i.e., communication apprehension) is only higher in speech-related tasks in the AWS groups compared to non-speech related tasks. They conclude that those AWS "who have a tendency to manifest greater anxiety in social communication will have higher task-related anxiety

when performing a speech task, such as conversations" (Ezrati-Vinacour & Levin, 2004, pp. 144).

Davis, Shisca, and Howell (2007) examined trait and state anxieties in adolescent PWS and PWNS. These researchers distinguished within the stuttering group between persistent PWS and recovered PWS. Results showed significant group differences between persistent PWS and person who do not stutter (PWNS) in three different states; (1) Asking for something in a shop, (2) Talking with a friend on the telephone, and (3) Answering a question in front of the class, but not for (4) Talking with a group of friends. Further, no differences in AWS and AWNS were stated in trait anxiety.

Mulcahy, Hennessey, Beilby and Byrnes (2008) found that among 19 adolescent PWS and 18 adolescent PWNS, trait, state and social anxiety were higher in PWS than in PWNS. Nevertheless, trait and state anxiety were always positively related to perceived difficulty with functional communication in daily situations for both groups. It is debatable whether the authors measure really trait anxiety, because they rather looked at state anxiety (i.e., communication apprehension) when relating anxiety levels to functional communication in daily situations.

In contrast, Miller and Watson (1992) found no higher state and trait anxiety levels in a group of 52 AWS compared to AWNS when measuring state and trait anxiety with the STAI (Spielberger, 1983) and the Erickson Modified 24 Scale (Andrew & Cutler, 1974). Further, Miller and Watson could not find a relationship between stuttering severity and anxiety; but did report higher levels of communication apprehension in AWS. They suggested that anxiety about speaking tasks is a predictable, rational response to negative communication experiences and negative evaluation from listeners that most AWS have experienced at different stages in their lives. Moreover, communication attitude for AWS got poorer with higher scores in self-ratings of stuttering frequency. Similarly, Poultan and Andrews (1994) pointed out that anxiety in stuttering is a reasonable reaction to invalidating effects of the condition. In summary, chronic stuttering is likely to be associated with long-term adjustments and social anxieties.

The majority of research in stuttering and anxiety has indicated a strong link be-

tween state anxieties (i.e., communication apprehension) and stuttering. This agrees with the common belief in the population of AWS and AWNS. Therefore, it is interesting to consider the research of Lincoln et al. (1996). The researchers surveyed 139 clinicians, 174 AWS, and 72 AWNS on their views related to trait and state anxiety, as well as communication apprehension. The findings showed that 87% of the interviewed AWS and 97% of the clinicians think that AWS differ from AWNS in state anxiety and communication apprehension, but only a small group believed that trait anxiety is involved in stuttering. Further results of the survey showed that only two-thirds of the clinicians regularly included anxiety management in their treatment program with AWS. This is a surprising finding, but it is likely to reflect the type of therapy program used by clinicians. Specifically, treatment programs involving direct fluency shaping tend to focus less on emotional, family, or associated issues (Menzies et al., 1999).

Anxiety can also be examined through the use of physiological measures such as heart rate changes, saliva, skin responses or fluctuations of the autonomic nervous system. One of the first studies considering physiological measurements of anxiety in AWS was performed by Janssen and Kraaimaat (1980) who found no relationship between physiological arousal and self reported communication apprehension while reading aloud when measuring skin conductance and heart rate. Weber and Smith (1990) measured skin conductance, peripheral blood flow and heart rate in AWS and AWNS during speech tasks (reading and spontaneous speech) and non-speech tasks (jaw movements and breath-holding task). They noted that the autonomic arousal levels during all activities were similar in AWS and AWNS. These results are consistent with earlier findings of Peters and Hulstijn (1984) who also failed to find differences in physiological arousal when comparing speech (reading and conversation) and non-speech related tasks (motor and intelligence tasks) between AWS and AWNS, but they reported higher communication apprehension in speech-related tasks in AWS than in AWNS.

Stuttering has an effect on self-esteem, self-image, self-perception, and quality of life when strong, often negative emotions (such as fear, anxiety, and shame etc.) are

evoked over years of stuttering (Craig, Blumgart, & Tran, 2009; Green, 1999; Klompas & Ross, 2004). Familiarity of negative emotions associated with previous speaking experiences often leads to communication apprehension and fear of speaking over the years, which then can contribute to social anxiety in social interactions (Alm, 2004; Caruso, Chodzko-Zajko, Bidinger, & Sommers, 1994; Guitar, 2006; Messenger et al, 2004). These findings have been consistent with results from Mahr and Torosian (1999) who compared socially phobic patients, with AWS and AWNS. Results indicated that AWS have more social anxiety and avoidance behaviour than AWNS. Further, no difference between AWS and social phobia participants could be found in trait anxiety, but AWS reported higher speech-related fear in social interactions (i.e., communication apprehension). Lincoln, Onslow, and Menzies (1996) conclude that

> "anxiety associated with the disorder is predominantly state anxiety about speaking situations in which that anxiety occurs. This is a particularly plausible explanation, considering that [...] PWS are not a homogeneous group in their experiences of anxiety [...]. Using standard "telephone" tasks, for example, may not produce anxiety in all subjects. Future experimental research on the role of anxiety in stuttering should focus on identifying individualized assessment tasks that maximise the likelihood of eliciting anxiety in each subject in order to measure its impact on stuttering rates" (Lincoln, Onslow, & Menzies, 1996, p. 8).

Menzies, Onslow and Packman (1999) point out that "the lack of evidence for a relationship between stuttering and anxiety may be a result of inadequate research designs regarding definitions and measures of anxiety, insufficient statistical power, or inappropriate speech tasks" (Alm, 2004, p. 124). For this reason, the present study sought to critically examine the influence of various speaking tasks in communication apprehension in AWS.

1.4 Speaking Conditions

The frequency of stuttering has been shown to vary under different speaking conditions, which is often attributed to communication apprehension (e.g., audience size and communication partner) (Hahn, 1940; Johnson, 1934; Porter, 1939; Siegel & Haugen, 1964; Steer & Johnson, 1936; Young, 1965, 1985). A review of studies examining stuttering in various speaking conditions is provided below. It is important to note in this review that, while a number of speaking conditions have been evaluated; few studies have examined three or more conditions.

1.4.1 Speaking alone or Face-to-Face

Early research has shown that speaking alone is one of the speaking situations with the lowest stuttering occurrence (Steer & Johnson, 1936; Svab, Gross, & Langova, 1972). Porter (1939) examined whether the influence of type of listener correlated with the frequency of stuttering. He found that an AWS' familiarity with a listener did not have an impact on speech fluency. Rather, the presence of a listener itself, as opposed to speaking alone, appeared to influence the fluency of an AWS (Porter, 1939).

Hahn (1940) examined the stuttering behavior in 52 AWS while reading alone, reading to a hidden listener and reading directly to a single listener. He found that the "increased complexity of the social element [...e.g., the presence of someone in the room] was associated with a greater amount on stuttering" (Hahn, 1940, p. 11). Svab, et al. (1972) found in 23 AWS while speaking alone and speaking with the researcher that all AWS stuttered significantly more in the investigator's presence than speaking alone, regardless of whether they were reading aloud or speaking spontaneously.

Martin and Haroldson (1988) compared the fluency of 10 AWS while speaking alone to speaking in a face-to-face conversation with one stranger. Results suggested that the percentage of stuttering was nearly twice as high while speaking to the stranger than speaking alone. Kalinowski, Stuart, Wamsley, and, Rastatter (1999) obtained similar findings and added that AWS also spoke fewer words per minute while someone was in the examination room compared to speaking alone (Kalinowski et al., 1999).

Besides speaking alone, Steer and Johnson (1936) found that the lowest rate of dysfluencies occurred when AWS spoke to a familiar person in comparison to speaking to an unfamiliar listener (Resick, Wendiggensen, Ames, & Meyer, 1978).

1.4.2 Speaking to an Audience

Among the different speaking situations, speaking to an audience appears to be associated with a high level of stuttering (Kalinowski et al., 1999). It is generally believed that stuttering tends to increase when there is more than one listener in the room compared to a single listener due to an increase in communicative stress (Andrews, Hoddinott, Craig, Howie, Feyer, & Neilson, 1983; Commodore & Cooper, 1978; Commodore, 1980; Dixon, 1955; Hahn, 1940; Johnson, Larson & Knott, 1937; Siegel & Haugen, 1964; Steer & Johnson, 1936; Van Riper & Hull, 1955; Young, 1965). Steer (1936) found that the highest amount of stuttering occurred in situations either when the audience was unfamiliar, or the audience size was relatively large (between two to eight persons)[1]. Porter (1939) showed evidence of a direct relationship between frequency of stuttering and audience size. Hahn (1940) reported that AWS have more stuttering moments when reading in front of a group, than when reading alone.

1.4.3 Speaking on the Telephone

One of the most threatening speaking situations for individuals who stutter is using the telephone. This is associated with both high levels of communicative stress and high levels of associated fear (Bray & James, 2009; Georgieva, 1994; James, Brumfitt, & Cudd, 1999; Kehoe, 1998; Leith & Timmons, 1983a; Silvermann, 1997; Zimmermann et al. 1997; Resick et al., 1978). Ladoucer, Cote, Leblond and Bouchard (1982) indicated that AWS "stuttered significantly more during telephone conversations than during [face-to-face] inverviews" (Ladoucer et al., 1982, p. 425). Leith and Timmons (1983a) noted that 72% of their sample of 130 AWS participants feared speaking on the telephone and rated calling another person on the phone as one of the top three

[1]Read more about audience familiarity, public speaking anxiety, and communication apprehension in AWNS in a detailed study by Beaucom (1995).

stressful situations in their daily life. In the same study, they reported that making a telephone call was for the majority of AWS a more fearful speaking situation than answering a telephone call (Leith & Timmons, 1983a). In a similar vein, James et al. (1999) found after surveying 201 AWS that making telephone calls were more problematic than answering them. James et al. concluded that the AWS's anxieties were higher than their AWNS counterparts, because a AWS is often afraid that the listener on the telephone would hang up on them, or that they might be misunderstood, or that they would not be able to get the words out, which are needed in a telephone conversational exchange. Furthermore, age differences were documented, with younger AWS showing more telephone avoidance behaviours than older AWS. The same effect appears to occur within more severe AWS, which has an impact on their quality of life with feelings of losing social isolation. Anticipation of making a telephone call leads often to covert behaviours such as postponement and avoidance (James et al., 1999). Similar findings were obtained by Georgieva (1994) in adolescent AWS, who rated telephoning as one of the most stressful speaking situations with one of the highest stuttering-inducing potential. Leith and Timmons (1983b) used a lie detector to detect stress-related behaviours in AWS while using the telephone, which was not observed in the AWNS group.

There are various explanations to why making telephone calls are so threatening for AWS (Guitar, 2006). The increase of stuttering frequency on the telephone may be a result of classical conditioning. Fear before making a telephone call and feelings such as a tightening of the throat are only some of the sensations an AWS may feel when a neutral stimulus (e.g., the telephone) and a secondary stimulus (e.g., speech dysfluencies) come together and evoke a response which often results in negative states such as communication apprehension. These negative emotions are exacerbated by reactions of the environment such as an impatient listener. When an AWS stutters severely on the telephone, then this can result in feelings of frustration, embarrassment and anxiety, creating a "vicious circle" over years (Guitar, 2006).

Speaking on the telephone is more likely to be difficult than speaking with a direct

communication partner, because in telephone conversations pauses are less accepted and can be more confusing for the communication partner than in a direct conversation (Kehoe, 1998). During a telephone conversation, the listener cannot see the AWS blocking; they can only hear silent pauses between words, which confuses the listener as they may assume the speaker is finished with his phrase (Jezer, 1997). In addition, to make the situation more complicated the telephone communication partner cannot use non-verbal communication signs such as pointing, which often help the AWS to get over blocks (Kehoe, 1998; James et al., 1999).

1.5 Cortisol Measurements

A specific way of analysing the physiological correlates of anxiety is to measure cortisol levels. Cortisol is a hormone (glucocorticoid), which is utilised as a biological marker of stress, anxiety and depression, in different medical and psychobiological studies (Levine, Zagoory-Sharon, Feldman, Lewis, & Weller, 2007). It is an end-product following hypothalamic-pituitary-adrenal (HPA) activation produced in the hippocampus region in the brain in different stress-provoking situations (Luecken, 2000; McEwen, 2001; Schiefelbein & Susman, 2006) with varying fluctuations during the day: mostly cortisol levels peak in the early morning, prior to awakening, while decreasing constantly during the day until they finally reach their lowest levels in the evenings (Levine, et al., 2007; Lewis, unpublished data, 2010). Furthermore, cortisol also affects immunity, learning, memory, neural plasticity, and emotions (Klimes-Dougan, Hastings, Granger, Usher, & Zahn, 2001). A depiction of cortisol fluctuations during the day in AWNS is shown in Figure 2. Literature widely asserts that deregulations in cortisol levels have a huge impact on pathological states of the brain such as hypercortisolism, which is often found in depression and/or chronic burnout while perceiving a longer period of permanent stress (Levine et al., 2007; Melamed, Ugarten, Shirom, Kahana, Lerman, & Froom, 1999; Pruessner, Baldwin, Dedovic, Renwick, Mahani, Lord, Meaney, & Lupien, 2005). Cortisol levels are also related to anxiety levels (Francis, 1989). When the body perceives stress or anxiety, the pituitary glands release hormones such as

epinephrine, norepinephrine, adrenaline, and cortisol. These hormones enter then the blood stream and are carried into the adrenal cortex, which results in increased cortisol secretion in the whole body (Garrod, 1958). An illustration of the regulation of cortisol levels via the hypothalamus and the pituitary gland is shown in Figure 3.

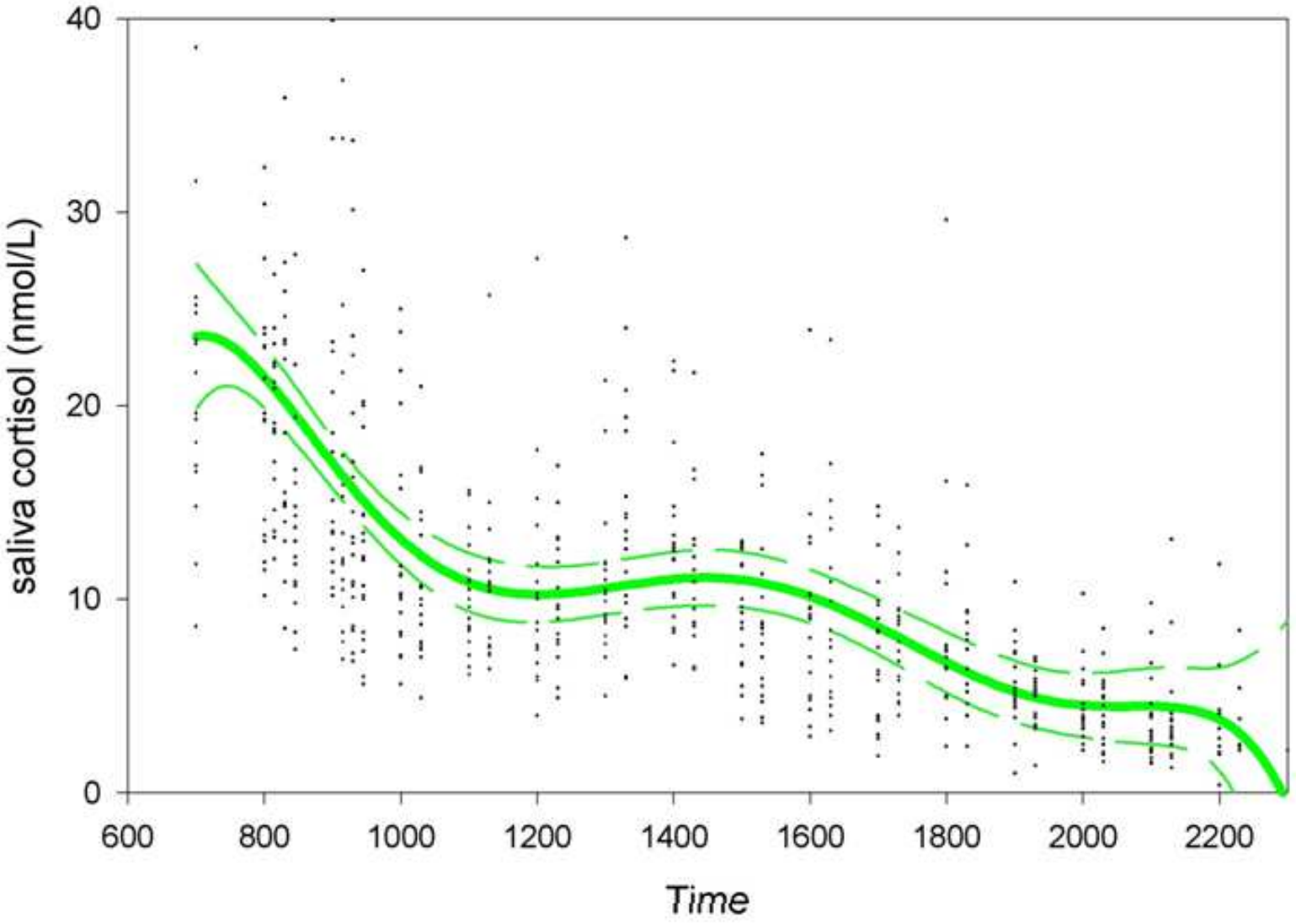


Figure 2: Saliva cortisol levels in AWNS of normal day curves with fluctuations. Green lines show means and one standard deviation (SD) (Lewis, 2010, unpublished data).

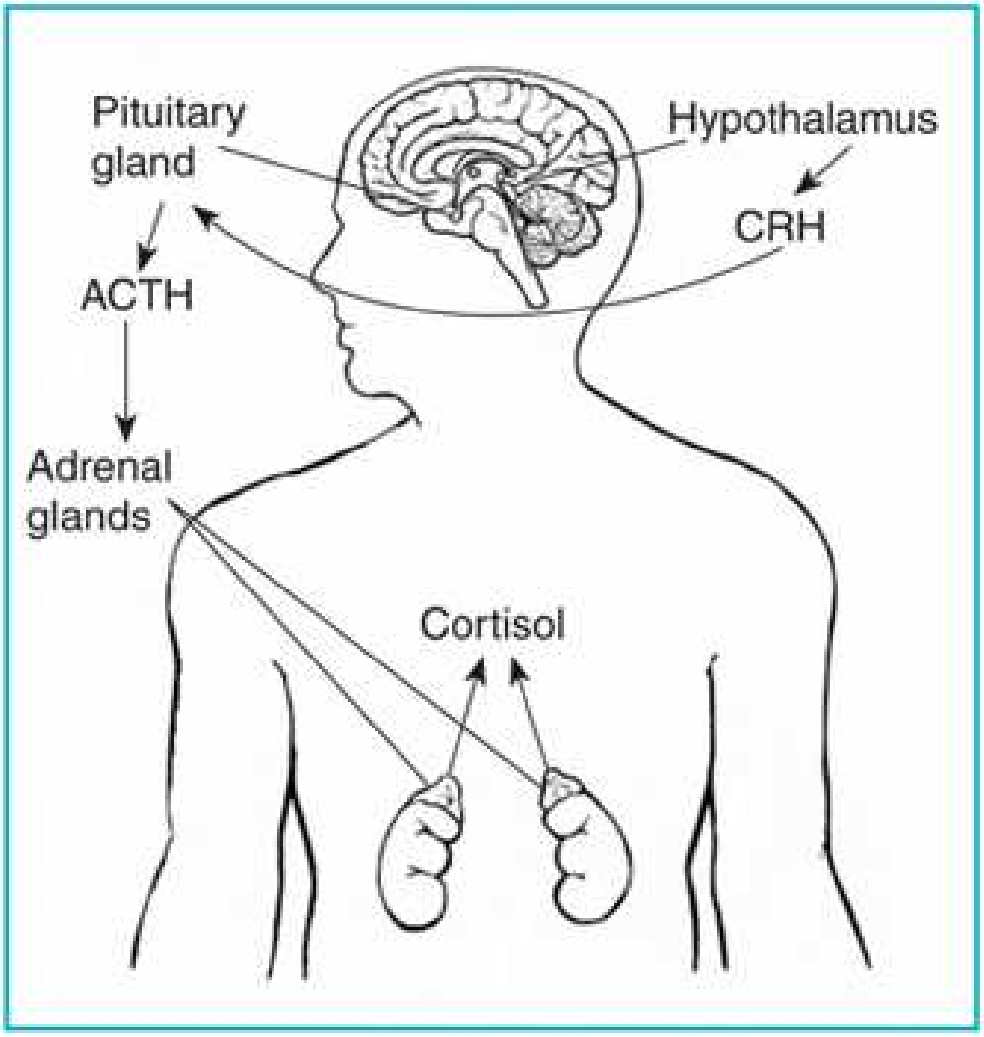


Figure 3: Regulation of cortisol through the hypothalamus and the pituitary gland in the body. Source: http://fromyourdoctor.com/topic.do?title=Cushing+s+Syndrome&t=10506.

Three methods are commonly used to measure cortisol: via blood, saliva or urine (Gozansky, Lynn, Laudenslager, & Kohort, 2005; Lewis, 2006). The main advantage of measuring cortisol through saliva samples is that it is a stress-free and non-invasive methodology, which allows for frequent and rapid sampling (Levine et al., 2007). Furthermore, saliva cortisol sampling can take place outside the clinic or laboratories without trained clinical stuff. However, measuring constant effects of saliva cortisol samples are very much dependent on the compliance of the participants, as they might provide insufficient saliva or are not in accordance from testing instructions (Levine et al., 2007). Although cortisol is only present in low concentrations in saliva, sensitive analyses such as radioimmunoassay following centrifugation allow detailed data about cortisol regulation of the body in anxiety provoking situations (Kirschbaum & Hellhammer, 1989; Phaal, 2007; Appendix F).

Few studies utilise cortisol responses as a measurement of anxiety in AWS. One exception is Blood, Blood, Bennett, and Simpson (1994) examined saliva samples from 11 AWS and 11 control AWNS (matched according to age, gender, and educational level) in a low stress (e.g., stress and hassle free time) and a high stress situation (e.g., before a final examination or on a stressful day). Participants also completed the *STAI* (Spielberger, 1983) and the *PRCA* (McCroskey, 1978), which measured their communication apprehension and their state and trait anxiety levels. Results indicated significant differences between AWS and AWNS cortisol levels during the high stress condition. However, Blood et al. (1994) could not find any differences in cortisol levels in the low stress situation, neither in self reported anxiety levels in the questionnaires between the two groups. No differences in communication apprehension measured by the *PRCA* (McCroskey, 1978) between the AWS group and the AWNS group could be found. The researchers inferred from those results that cortisol levels elevate in AWS when they find themselves in high stress situations such as when they are stressed by an unexpected event, but the researchers did not distinctively distinguish between different states related to speaking situations.

A follow-up study by Blood, Blood, Frederick, Wertz, and Simpson (1997) exam-

ined communication apprehension and cortisol levels before and after fulfilling mental arithmetic tests in 11 AWS and 11 AWNS for a period of five minutes. Further, participants were requested to complete the *PRCA* (McCroskey, 1978) to compare physiological arousal with self reported communication apprehension. Regardless of whether participants were of the AWS or of the AWNS group, researchers found a significant correlation between communication apprehension and cortisol levels. However, no significant differences in cortisol responses between AWS and AWNS were found.

Results of the two cortisol studies completed by Blood and his colleagues (1994, 1997) seem to appear inconclusive and contradictory. Inconsistencies in the findings of those studies could be attributed to differences in cortisol sampling, as well as a lack of control over the sampling states (e.g., speech-related or non speech-related anxiety).

Therefore, examining cortisol levels in AWS may serve to clarify whether there is a physiological difference in anxiety levels between AWS and AWNS. Further, examining cortisol levels in AWS while systematically examining across a range of specific speaking conditions (e.g., speaking to a friend, speaking on the telephone, or speaking to an audience) may prove revealing findings of possible relationships between physiological arousal and self-perception of anxiety in AWS.

Statement of the Problem

There is a paucity of research showing strong evidence that AWS experience greater communication apprehension than AWNS. Most of the evidence is based on surveying the attitudes of AWS and AWNS by self reported questionnaires (Craig, 1990; Ezrati-Vinacour & Levin, 2004; Lincoln & Onslow, & Menzies, 1996; Gabel et al., 2002; Miller & Watson, 1992; Mulcahy, Hennessey). Research has shown that stuttering frequency varies according to different speaking conditions, with more stuttering found in conditions reflecting greater communication anxiety (Hahn, 1940; James et al., 1999; Leith & Timmons, 1983a; Porter, 1939; Siegel & Haugen, 1964; Young, 1985). In addition, there is evidence that direct physiological measurement of anxiety (i.e., cortisol) may be linked to communicative stress (Blood et al, 1994, 1997). Missing from these past studies is a detailed examination of communication apprehension across a number of speaking conditions. Therefore, the present study attempted to examine the relationship between cortisol responses and perceptual judgments of communication apprehension across a variety of speaking tasks in AWS and AWNS. The study was designed to explore whether anxiety levels fluctuate according to speaking conditions or whether they remain stable regardless of speaking conditions.

The following research hypotheses were posed:

(1) AWS will significantly differ from AWNS in cortisol levels in varying speaking situations.

(2) AWS will significantly differ from AWNS in self reported anxiety levels in varying speaking situations.

(3) Anxiety measurements of cortisol levels and self-perception will significantly positively correlate in varying speaking situations among AWS.

2 Methodology

2.1 Participants

AWS Participants. Ten (six man & four woman) healthy AWS aged between 19 to 62 years, with a mean age of 40 years participated in the study. The AWS participants had no psychological, neurological or hearing disorder and were recruited through the University of Canterbury Speech and Hearing clinic, as well as through the Canterbury Speak Easy Association. Initial criteria for inclusion were the prior diagnosis of stuttering, as well as a self-reported confirmation of stuttering. All participants were asked to rate the severity of their stuttering on a 10-point rating scale (1=no stuttering & 10=severe stuttering). In addition, all participants reported receiving formal treatment for their stuttering at some point in their lives. Three participants were receiving treatment during the time of data collection (AWS 8, 9, & 10). Two of the participants (AWS 1 & 2) reported receiving specific treatment (e.g., Personal Construct Therapy or Psychotherapy) to address matters of speech-related anxiety. All participants were paid for their involvement in the project. General characteristics of the AWS participants are listed in Table 5.

AWNS Participants. Ten (six man & four woman) healthy sex- and aged-matched AWNS, with a mean age of 39 years served as controls. None of the participants reported having any psychological, neurological or hearing disorder. The AWNS participants were recruited through the student and staff body of the University of Canterbury and through friends of the researcher. The general characteristics of the AWNS participants are listed in Table 6. The study was approved by the University of Canterbury Human Ethics Committee and all participants provided informed written consent. A copy of the project information sheet, as well as the consent form is provided in Appendix B.

Participant	Sex	Age	Type of Stuttering	History of Therapy	Anxiety	Stuttering Severity	CSS	OASES	OASES Com	Onset	Occupation
1	M	62	blocks	Yes	Yes	2	1.9	33.9	35.8	4	Retired
2	W	53	blocks, prolongations, repetitions	Yes	Yes	3	1.7	43.5	58.2	5	Early Childhood Educator
3	W	20	blocks, nonverbal superflous behaviour	Yes	Yes/No	5	2.3	51.9	50	4	Waitress
4	M	42	blocks, avoidance behaviour	Yes	Yes	2	1.8	35.8	40	4-5*	Salesman
5	W	56	prolongations, repetitions	Yes	Yes	1	1	25	20.8	6-7*	Housewife
6	M	58	blocks, prolongations, repetitions	Yes	No	2	1.4	29.6	24.8	4	Bus driver
7	M	34	repetitions	Yes	Yes	3	1.1	36.2	31.2	5	Technician
8	W	21	blocks, nonverbal superflous behaviour	Yes	Yes	6	2.6	58.3	59.2	4-5*	Nurse
9	M	19	blocks	Yes	No	4	2.1	53.7	50.8	4-5*	Apprentice
10	M	33	blocks	Yes	Yes/No	4	2.6	61.2	64.2	6-7*	Business Analyst
Mean		39.8				3.2	1.85	42.91	43.5	4.6	
SD		16.75				1.55	0.57	12.67	15.18	0.84	

Table 5: General characteristics of adults who stutter (AWS). The table includes sex (**M**an and **W**oman), age, type of stuttering, history of therapy, anxiety, self-rated stuttering severity, Communcation Situation Scale (CSS), general rate of the Overall Assessment of the Speaker‘s Experience of Stuttering (OASES), and its subtest Communication in Daily Situations (OASES COM), age of stuttering onset, and current job or occupation. The overall mean and standard deviation (SD) are provided. *For the age of onset and the years of stuttering the lower number was taken when participants gave a range of numbers. Note that this is roughly the age which the participants could remember that their stuttering started.

Participant	Sex	Age	History of Speech Therapy	Anxiety	Occupation
1	M	60	No	Yes/No	Librarian
2	W	51	No	No	Researcher/ Lecturer
3	W	20	No	No	Student
4	M	39	No	No	Consultant
5	W	58	No	No	Personal Assistant
6	M	56	No	No	Libarian
7	M	34	No	No	Researcher/ Lecturer
8	W	21	No	No	Student
9	M	19	No	Yes/No	Student
10	M	32	No	Yes/No	Service Coordinator
Mean		39			
SD		16.31			

Table 6: General characteristics of adults who do not stutter (AWNS). The table includes sex (**M**an and **W**oman), age, history of speech therapy, and current job or occupation. The overall mean and standard deviation (SD) are provided.

2.2 Test Instruments

Two measures of speech fluency were collected from the AWS, and two anxiety measures were collected for both the AWS and the AWNS groups.

2.2.1 Fluency Measures

Two measures of stuttering were taken from each AWS participant. The first measure involved each participant rating their stuttering severity on a 10-point scale (1=no stuttering, and 10=severe stuttering). The second measure involved completing an adapted form of the Communication Situation Scale *(CSS)* (Green, 1999). The *CSS* measures self reported stuttering severity in different speaking situations. The *CSS* is originally derived from the Willingness to Communication Scale (McCroskey, 1992). The adapted version of the *CSS* consisted of 13 specific everyday communication situations, including speaking situations in different communication contexts, such as speaking alone vs. face-to-face, speaking with familiar vs. unfamiliar listeners, speaking to a difficult vs. an easy audience, speaking to more listeners, and speaking on the telephone. The participants had to rate their perceived stuttering severity in each speaking situation on a scale from 1-4 (1=no stuttering; 2=mild; 3=moderate; 4=severe). A copy of the *CSS* is provided in Appendix D.

2.2.2 Anxiety Measures

Assessment of each participant's anxiety (for both AWS & AWNS groups) was determined on the basis of a combination of self-perception measures and a specific physiological measure. The specific measures are as follows:

Self-perception measures. The first self-perception measure involved having each participant rate their speech-related anxiety according to four specific situations: (1) speaking to a friend, (2) speaking to a stranger, (3) speaking to a group of four strangers, and (4) speaking on the telephone[2]. Ratings were based on a scale ranging

[2]The different speaking situations used in this study will be highlighted in subsequent text in the following way: (1) speaking to a Friend, (2) speaking to a Stranger, (3) speaking to a Group of four strangers, and (4) speaking on the Telephone.

from 0 ("I do not feel anxious when...") to 10 ("I feel anxious when..."), similar to the format used for the Speaking Task Response Scale *(STRS)* (Bray & James, 2009). A copy of the adapted version of the *STRS* is provided in Appendix E. The second measure involved having each AWS participant complete the Overall Assessment of the Speaker's Experience of Stuttering *(OASES)* (Yaruss & Quesal, 2006), which was used to obtain information about the participants' attitude towards communication apprehension in daily situations. A copy of the *OASES* is shown in Appendix D. The *OASES* is comprised of four sections, which encompass general perspectives about stuttering, affective, behavioural, and cognitive reactions to stuttering, functional communication difficulties, as well as a general overview of the impact of stuttering on the quality of life of an AWS. Section three of the *OASES (OASES COM)* was used to gain more specific information regarding communication apprehension in specific speaking situations. Items on the *OASES* are self-scored on a 5-point Likert scale (1=not at all difficult, 2=not very difficult, 3=somewhat difficult, 4=very difficult, and 5=extremely difficult). The OASES has demonstrated strong reliability, with coefficients ranging between 0.90 to 0.97. Validity data are also strong ranging with coefficients between 0.68 and 0.83 (Yaruss & Quesal, 2006).

Physiological measures. Each of the participants (AWS & AWNS) was asked to provide saliva samples to obtain a measure of cortisol level across a variety of speaking situations. The samples were collected by chewing softly on a non-flavoured Sarstedt Salivette® dental roll for approximately 30-60 seconds. An illustration of the procedures to collect saliva with the Salivette® methodology is shown in Figure 4. After data collection, the samples were frozen at -20C for two months before they were sent to a steroid and immunobiochemistry laboratory (Canterbury Health Laboratories), where they were analysed by a steroid biochemist. The biochemist provided the researcher with a specific numeric value for each of the saliva samples, reflecting the level of cortisol contained in the sample.

Figure 4: Taking a saliva sample with the Salivette® methodology.

2.3 Procedures

Data were collected from each participant on five consecutive sessions over a one-week period. The duration of each session ranged from 30 to 45 minutes. All sessions took place in the same clinic room of the Department of Communication Disorders and occurred between the hours of 3-6 pm during those five days. The specific time of data collection was tightly controlled because of known fluctuations in cortisol levels that can occur during the day. The period of 3-6pm is known to be a stable time of the day (Kirschbaum & Hellhammer, 1989; Lewis, 2010, unpublished data) and was also a convenient time for the participants to visit the clinic. The first session served as a baseline data collection session. During this session the details of the study were explained to each participant and written consent was obtained. As part of the session, each of the AWS participants completed the adapted *CSS* (Green, 1999) and rated the overall severity of their stuttering on a 10-point rating scale (1=no stuttering & 10=severe stuttering). During this baseline session, a saliva sample was obtained for both AWS and AWNS participants. The researcher wore latex gloves to handle the Salivette® roll. The participant was instructed to chew on the Salivette® roll until the roll was drenched with saliva. During this baseline saliva sampling, the researcher left the room for approximately 60 seconds while the participant chewed on the roll. The rationale for leaving the room during the baseline sample was to ensure there was no speaking occurring during the sampling. The goal was to obtain a baseline cortisol level with which later, speech-related samples could be compared. Once the roll was drenched with saliva, the researcher removed the roll and placed it in its airtight plastic container. The container was then labeled with the participant's initials, the collection date and time, the marking "baseline" and stored in a freezer. At the conclusion of the first session, each participant was "pre-warned" as to the specific speaking situation they were required to complete during the next session (i.e., the next day). This 24-hour "pre-warning" was designed to place special emphasis on the upcoming speaking situation so as to evoke a high level of communication apprehension. The speaking situation was either (1) Speaking with a Friend, (2) Speaking with a Stranger, (3)

Speaking with a Group of four strangers or (4) Speaking on the Telephone. The next session occurred exactly 24-hours later. At the start of this session, each participant had to first complete the adapted form of the *STRS* (Bray & James, 2009) questionnaire to obtain an estimate of their self reported anxiety associated with the upcoming speaking task. Once the *STRS* was completed a "*pre*-speaking" saliva sample was obtained, according to the procedures outlined above. The researcher remained in the room during the collection of the pre-speaking saliva sample. Once the sample was obtained the participant was required to partake in the activity that was "pre-warned" during the previous day. The participant was then engaged in the speaking task for approximately ten minutes. Following the completion of the speaking task, the participant was required to complete the *STRS* to obtain a self reported estimate of anxiety associated with completing the specific speaking task. Once the *STRS* was completed a "*post*-speaking" saliva sample was obtained. All salivettes® for the pre- and post-speaking tasks were appropriately labeled and stored. Sessions two through five followed the same procedures with the exception that no "pre-warning" took place in the last session. The AWS participants were required to complete the *OASES* (Yaruss & Quesal, 2006) questionnaire during the last session.

The speaking situation involving a Friend required each participant to personally choose a friend to accompany them to the session. When talking to a Friend, participants were required to talk about their mutual interests. Talking to a Stranger required the participants to share their personal interests and hobbies. When talking to a Group, participants were required to talk about their current occupation or job. The Stranger and Group speaking situation involved different listeners (3 man listeners from 24-32 years and 15 woman listeners from 19-64 years) drawn from the student body of the Department of Communication Disorders. The Telephone speaking situation required the participant to make a telephone call to a local travel agency to enquire about the cost of air travel to Italy. Literature has shown that making a telephone call is rated as more difficult than receiving a telephone call, which is why making a telephone call was chosen in the present study (James et al., 1999; Ormond,

1981). The order of the four speaking situations was randomised across all AWS and AWNS participants. A flow chart of data collection procedures is provided in Figure5.

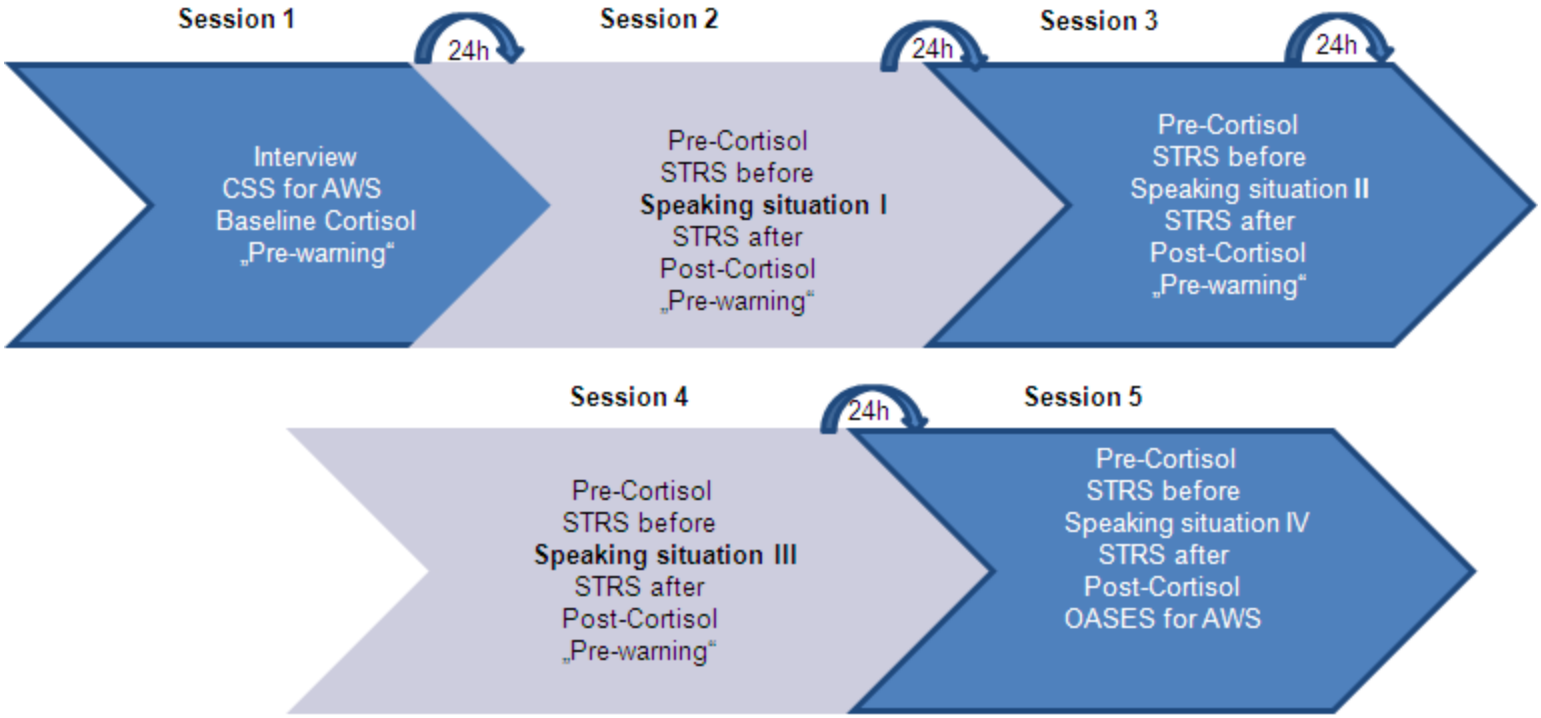


Figure 5: Flowchart of the sequence of data collection spanning over a one-week period. Session 1 involved filling in the *CSS* (Green, 1999) and collection of the Basal cortisol sample. Session 2-5 involved collection of cortisol samples during *pre-* and *post*-speaking situations as well as the pre- and post-speaking self reported anxiety ratings of the adapted *STRS*. The conclusion of Session 5 involved the administration of the *OASES* (Yaruss & Quesal, 2006) in the AWS group. Note session 2-5 had been randomised between the participants.

2.4 Data Analyses

Data collected from the self reported stuttering ratings (stuttering severity rating & *CSS*) (Green, 1999) were analysed to determine the self reported stuttering severity (only for the AWS group) in different speaking situations. Results from the adapted *STRS* (Bray & James, 2009) for the AWS and AWNS groups and the *OASES* (Yaruss & Quesal, 2006) only for the AWS group were obtained to determine individual perceived communication apprehension according to different speaking situations. The *STRS* scores were calculated and compared between the AWS and the AWNS group to determine differences in communication apprehension.

The Salivette® rolls (180 in total) were delivered to the Steroid and Immunobiochemistry Laboratory of the Canterbury District Health Board (Christchurch, New Zealand). The saliva analysis involved extraction of cortisol from the samples and the determination of the individual cortisol levels, which are described in more detail in Appendix F. After completion of the analysis, the researcher was provided with the specific cortisol levels corresponding to each Basal (without speaking), *pre*- and *post*-speaking situation collected for each participant.

The cortisol and questionnaire data for each participant were combined to form group data according to the AWS and AWNS groups. The data were analysed with a combination of analysis of variance tests *(ANOVA)* and correlational analyses. The tests were designed to examine within-group differences in anxiety levels across speaking situations, as well as between-group differences (AWS vs. AWNS) in anxiety for each speaking situation.

3 Results

The results are presented in three sections. The first section contains individual and group results regarding the cortisol analysis of saliva collected from AWS and AWNS at baseline, pre- and post-speaking times. The second section contains individual and group results regarding self reported anxiety levels collected from AWS and AWNS at baseline, pre- and post-speaking times. The third section contains the results of the correlational analysis of cortisol values, self-perception values and values based on questionnaires and other speech-related factors.

3.1 Cortisol Results

AWS. The results of the cortisol analysis for the AWS participants are listed in Table 7. The mean cortisol level for the baseline was 10.88 (SD=4.16). Across the *pre*-speaking situations, the group mean cortisol level ranged from 11.35 (Fb) to 21.88 (Gb). Across the *post-s*peaking situations, the group mean cortisol ranged from 11.01 (Sa) to 35.82 (Ta). *AWNS.* The results for the cortisol analysis for the AWNS participants are shown in Table 8. The mean value cortisol level for the baseline was 8.58 (SD=2.85). Across the *pre*-speaking situations, the group mean cortisol level ranged from 8.63 (Gb) to 11.93 (Fb). Across the *post*-speaking situations, the group mean cortisol ranged from 9.19 (Sa) to 12.06 (Fa).

AWS vs. AWNS. To determine whether the cortisol values differed significantly between AWS and AWNS across the speaking situations, a two-way *ANOVA* was performed. The within-groups factor was speaking situation and the between-groups factor was speaking group. The results of the *ANOVA* for the *pre*-speaking cortisol analysis indicated no significant main effect for speaker group [$F(1,18)=3.889$, $p<0.06$], as well as for speaking situation [$F(3,3)=1.099$, $p<0.35$]. There was no significant group-by-situation interaction [$F(3,54)=2.365$, $p<0.08$]. The results of the *ANOVAs* indicated there was no difference in cortisol levels across the speaking situations for both groups. An illustration of the mean cortisol levels for AWS and AWNS at baseline and in the four different speaking situations is provided in Figure 6.

AWS																	
Anxiety Measurement	Cortisol									Self-perception							
Participants	B	Fb	Fa	Sb	Sa	Tb	Ta	Gb	Ga	Fb	Fa	Sb	Sa	Tb	Ta	Gb	Ga
1	8.6	7.6	6.9	11.4	13.5	11.9	28.3	8.7	36.1	1	1	2	2	3	5	2	2
2	12.6	6.6	6.9	10.3	7.4	7.2	6.9	8.7	11	1	1	4	6	2	3	3	6
3	9.8	10.8	9.6	9.4	8.3	10.3	10.8	30.9	16.7	0	0	4	4	10	10	5	2
4	7.2	6.6	8.5	8.5	8.5	7.8	9.1	6.5	9.8	0	0	1	0	3	3	2	2
5	7.3	8.4	10.2	8.2	10	11.8	6.6	8.8	6.6	0	0	1	0	1	1	1	0
6	18.1	21.3	11.8	9.7	6.8	5.2	7.4	78.1	44.1	0	0	0	0	0	1	1	1
7	11.4	6.9	6.6	9.8	7.4	9.5	8.5	10.1	8.2	0	0	5	2	4	3	6	0
8	17.4	8.6	25.6	26.3	17.3	26.1	252.7	18.9	49.4	1	1	7	8	10	8	7	5
9	10.5	20.1	28.2	15	13.7	20.6	13.7	35.3	26	1	0	3	3	4	1	2	1
10	5.9	16.6	12.6	19.2	17.2	17.9	14.2	12.8	16.1	2	1	4	2	3	4	5	3
Mean	10.88	11.35	12.69	12.78	11.01	12.83	35.82	21.88	22.4	0.6	0.4	3.1	2.7	4	3.9	3.4	2.2
SD	4.16	5.76	7.79	5.83	4.08	6.64	76.47	22.13	15.68	0.70	0.52	2.13	2.67	3.40	3.04	2.17	1.99

Table 7: Salivary cortisol levels (Cortisol) and self reported anxiety (Self-perception) levels collected at Basal, *Pre*- and *Post*-conversation sampling times for adults who stutter (AWS) in different speaking situations: speaking to a friend before (Fb) and after (Fa), speaking to a stranger before (Sb) and after (Sa), speaking to a group before (Gb) and after (Ga), and speaking on the telephone before (Tb) and after (Ta). The group means and standard deviations (SD) are also included.

AWNS																	
Anxiety Measurement	Cortisol									Self-perception							
Participants	B	Fb	Fa	Sb	Sa	Tb	Ta	Gb	Ga	Fb	Fa	Sb	Sa	Tb	Ta	Gb	Ga
1	7.5	7.5	6.3	8.4	7.9	9	7.8	7	6.5	0	0	2	1	2	4	4	2
2	5.6	4.6	6.6	4.8	3.8	5.8	5.8	5.1	5	0	0	0	0	0	0	0	0
3	7.8	12.4	12.6	26.3	18.8	8.3	9.1	13.1	12	0	0	0	0	1	0	0	0
4	5.1	8.3	9.7	7.3	8.6	8.8	6.5	7	15.4	0	0	1	0	2	0	1	1
5	7.3	13.1	9.8	4.8	6.1	11	8.2	5.9	5.1	0	0	0	0	0	0	0	0
6	8.3	9.7	12	7.9	8.8	7.1	11.8	7.2	13.7	1	1	2	3	2	6	2	4
7	8	11.9	10.2	9.2	8.7	11.8	16.2	10.1	10.9	1	1	2	2	1	1	2	4
8	14.3	27.1	30.1	7.7	9.3	9	9.3	12.5	9.5	0	0	0	0	0	0	0	0
9	12.4	11.5	11.9	10.9	7.7	9.9	15	11.3	14.9	1	2	1	1	2	3	3	4
10	9.5	13.2	11.4	9.8	12.2	9.8	7.7	7.1	9	0	0	2	3	3	8	3	4
Mean	8.58	11.93	12.06	9.71	9.19	9.05	9.74	8.63	10.2	0.30	0.40	1.00	1.00	1.30	2.20	1.50	1.90
SD	2.85	6.01	6.69	6.15	4.01	1.75	3.51	2.87	3.86	0.48	0.70	0.94	1.25	1.06	2.94	1.51	1.91

Table 8: Salivary cortisol levels (Cort) and self reported anxiety (Self) levels collected at Basal, *Pre-* and *Post*-conversation sampling times for adults who do not stutter (AWNS) in different speaking situations: speaking to a friend before (Fb) and after (Fa), speaking to a stranger before (Sb) and after (Sa), speaking to a group before (Gb) and after (Ga), and speaking on the telephone before (Tb) and after (Ta). The group means and standard deviations (SD) are also included.

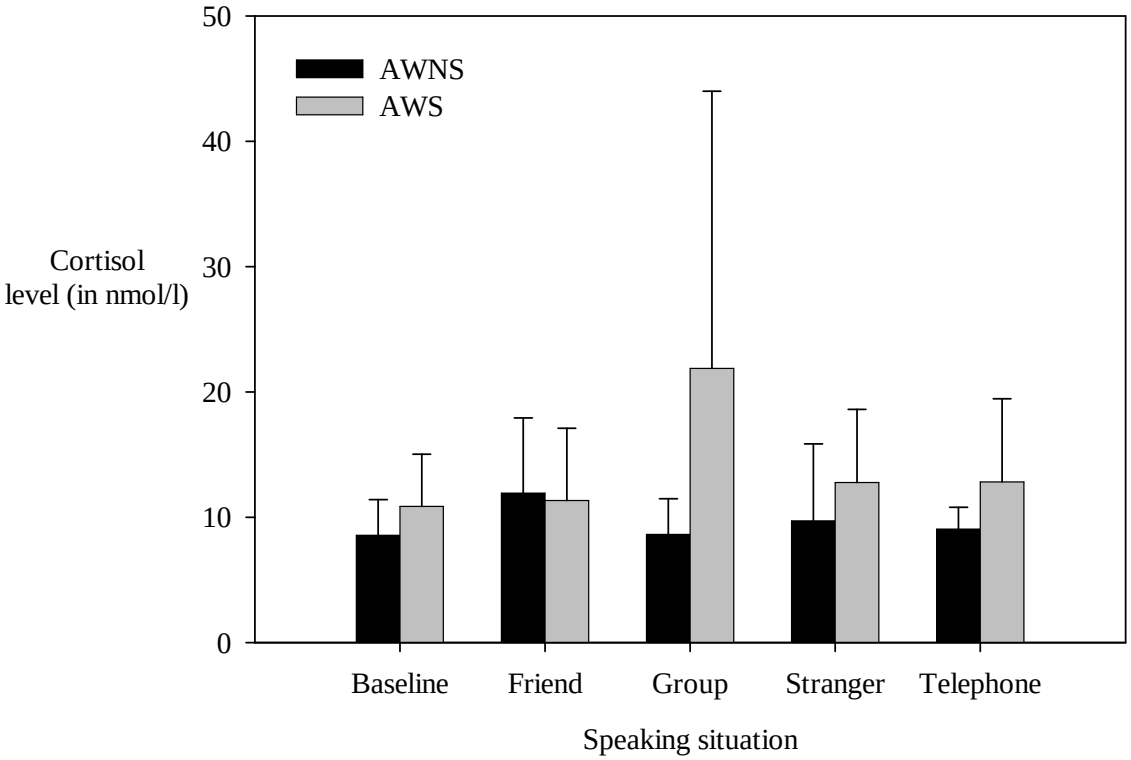


Figure 6: Mean cortisol levels for AWS and AWNS at baseline sampling and in four different speaking situations (Friend, Group, Stranger and Telephone) collected at *Pre*-conversation sampling times. Standard deviations are also indicated.

The results of the ANOVA for the *post*-speaking cortisol analysis indicated no significant main effect for speaker group [$F(1,18)=1.821$, $p<0.19$], as well as for speaking situation [$F(3,3)=0.929$, $p<0.43$]. There was no significant group-by-situation interaction [$F(3,54)=1.050$, $p<0.37$]. The results of the ANOVA indicated there were no differences in cortisol levels across the speaking situations for both groups. The mean cortisol levels for AWS and AWNS at baseline and in the four different speaking situations are presented in Figure 7.

As a way of examining the change in cortisol levels between *pre*- and *post*-speaking situations a "difference" score was calculated. The difference was determined by subtracting the post-speaking situation cortisol value from the corresponding pre-speaking situation cortisol value. A positive difference value would indicate an increase in cortisol levels at the *post*-speaking situations sample compared to the *pre*-speaking sample. Examination of the Figure 8 indicates minimal change in cortisol for both groups, with the exception of AWS in the Telephone situation. In this situation, the overall anxiety level for the AWS group was noticeably higher in the *post*-speaking situation with considerable variability. Results of the ANOVA for the difference scores indicated no significant main effect for speaking situation [$F(4,4)=1.105$, $p<0.36$], and speaker-group [$F(1,18)=0.580$,$p<0.45$]. There was no speaker group-by-situation interaction [$F(4,72)=1.015$, $p<0.4$]. The overall results of this analysis are displayed in Figure 8.

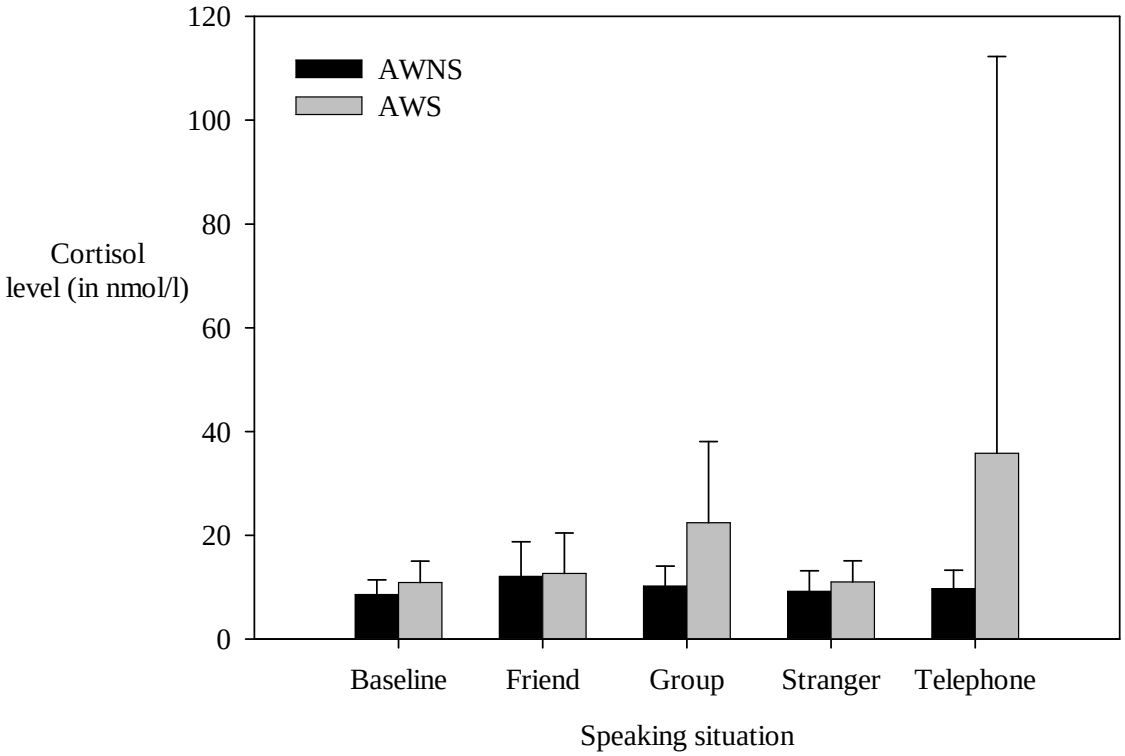


Figure 7: Mean cortisol levels for AWS and AWNS at baseline sampling and in four different speaking situations (Friend, Group, Stranger and Telephone) collected at *Post*-conversation sampling times. Standard deviations are also indicated.

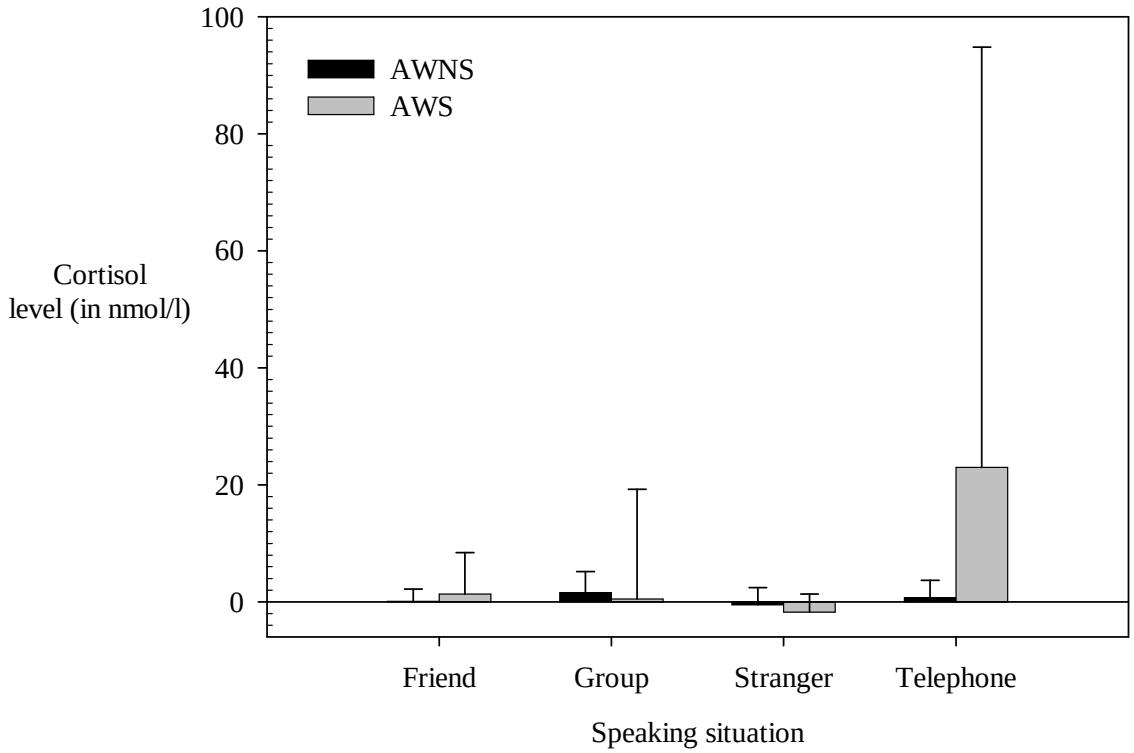


Figure 8: Difference in cortisol levels between the *Pre*- and *Post*-conversation sampling for AWS and AWNS in four different speaking situations (Friend, Group, Stranger and Telephone).

3.2 Self-Perception Results

AWS. The results of the self-perception analysis for the AWS participants are listed in Table 7. Across the *pre*-speaking situations, the group mean self reported anxiety levels ranged from 0.6 (Fb) to 4 (Tb). Across the *post*-speaking situations, the group mean self reported anxiety levels ranged from 0.4 (Fa) to 3.9 (Ta).

AWNS. The results for the self-perception analysis for the AWNS participants are listed in Table 8. Across the *pre*-speaking situations, the group mean self reported anxiety level ranged from 0.3 (Fb) to 1.5 (Gb). Across the *post*-speaking situations, the group mean self reported anxiety level ranged from 0.4 (Fa) to 2.2 (Ta).

AWS vs. AWNS. To determine whether the self reported anxiety levels differed significantly between AWS and AWNS across the speaking situations, a two-way ANOVA was performed. The within-group factor was speaking situation and the between-group factor was speaking group. The results of the ANOVA for the *pre*-speaking self-perception analysis indicated a significant main effect for speaker group [$F(1,18)=7.402$, $p<0.01$], as well as for speaking situation [$F(13,3)=12.899$, $p<0.001$]. There was a significant group-by-situation interaction [$F(3,54)=3.39$, $p<0.024$]. The results of follow-up q-tests (Tukey Test) identified no significant differences in self-perception scores for the AWNS in each speaking situation. Significant differences were identified for the AWS group in their self-perception between Friend and Group [$q=7.12$, $p<0.001$], between Friend and Stranger [$q=6.36$, $p<0.001$], and between Friend and Telephone [$q=8.64$, $p<0.001$)]. The overall results of this analysis are displayed in Figure 9.

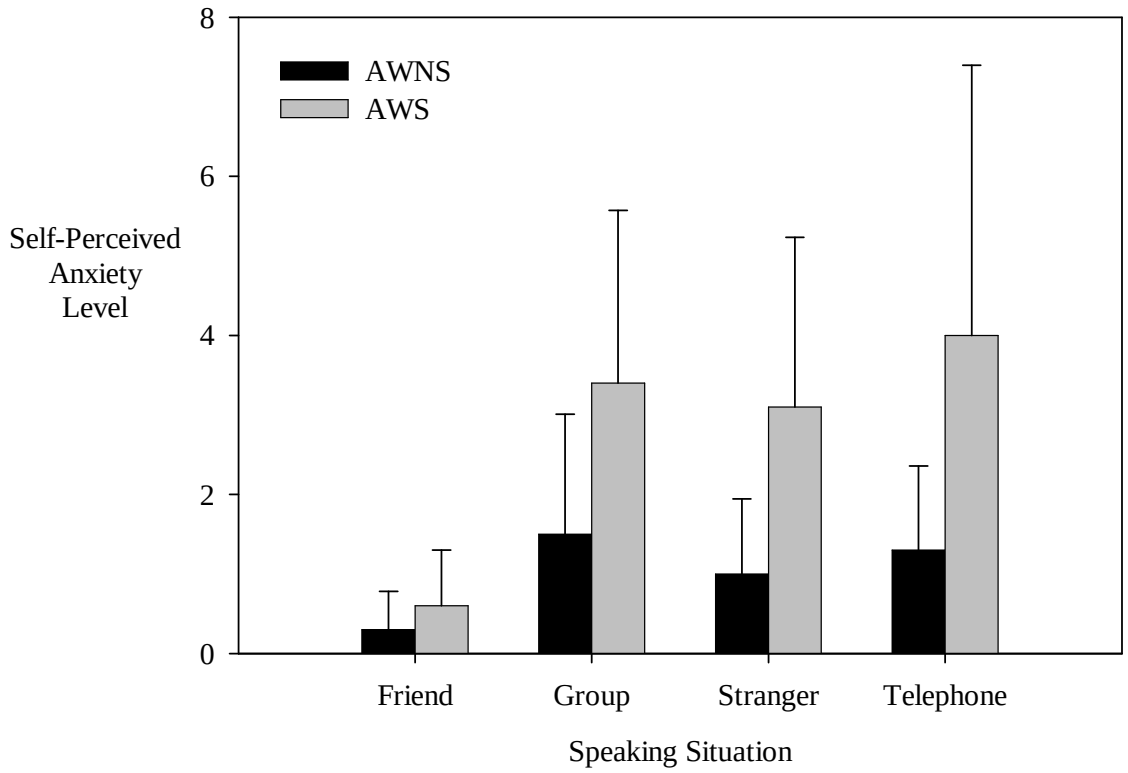


Figure 9: Mean self reported anxiety levels for AWS and AWNS in four different speaking situations (Friend, Group, Stranger and Telephone) collected at *Pre*-conversation sampling times. Standard deviations are also indicated.

The results of the *ANOVA* for the *post*-speaking self-perception analysis indicated no significant main effect for speaker group [$F(1,18)=1.67$, $p<0.22$], and no significant group-by-situation interaction [$F(3,54)=1.78$, $p<0.16$]. There was a significant main effect for speaking situation [$F(3,3)=10.45$, $p<0.0001$]. Follow-up q-test identified significant differences in self-perception scores for the combined groups (AWS and AWNS) between Friend and Group [$q=4.88$, $p<0.006$], between Friend and Stranger [$q=4.29$, $p<0.01$], and between Friend and Telephone [$q=7.84$, $p<0.001$)]. Overall results of this analysis are presented in Figure 10.

As a way of examining the change in self report anxiety between *pre*- and *post*-speaking situation samples, a difference score was calculated. The difference was determined by subtracting the *post*-speaking situation value from the corresponding *pre*-speaking situations value. A positive difference value would indicate an increase in self report anxiety at the *post*-speaking situation sample compared to the *pre*-speaking sample. Results of the ANOVA for the difference scores indicated no significant main effect for speaking situation [$F(3,3)=1.18$, $p<0.32$], and speaker-group [$F(1,18)=3.61$,$p<0.07$]. There was no speaker group-by-situation interaction [$F(3,54)=1.18$, $p<0.32$]. The overall results of this analysis are displayed in Figure 11. Examination of the Figure 11 indicates minimal change in self-perception for both groups.

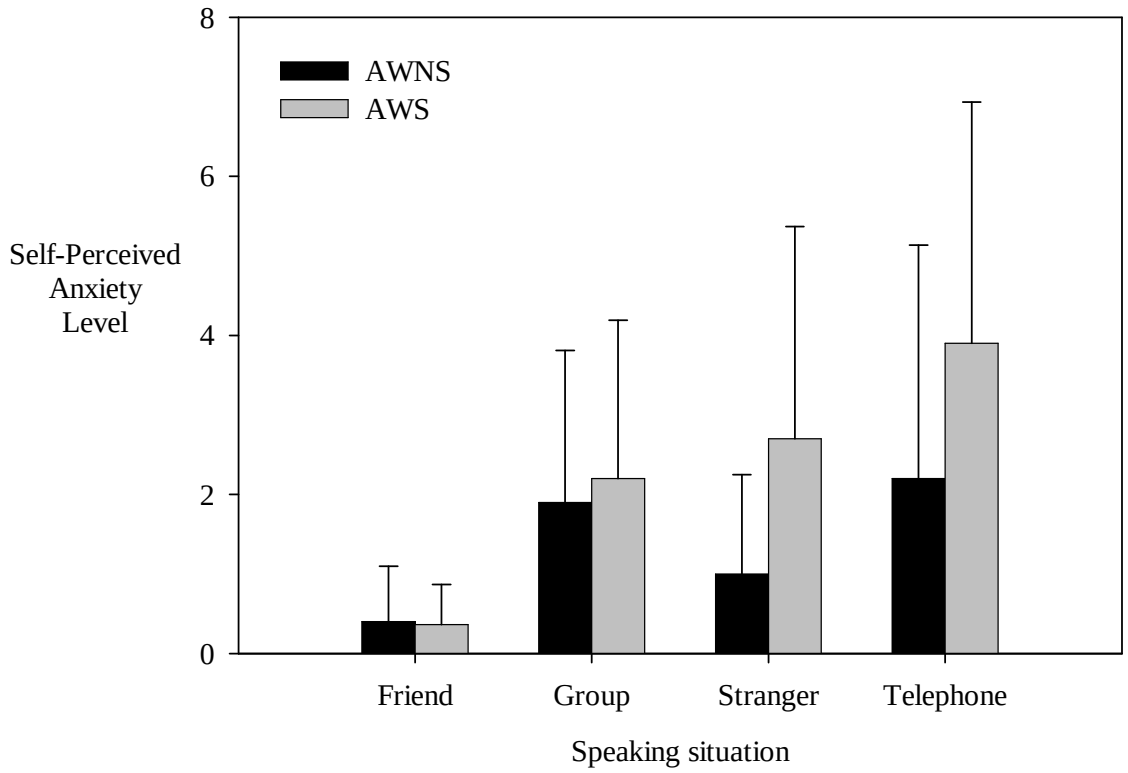


Figure 10: Mean self reported anxiety levels for AWS and AWNS in four different speaking situations (Friend, Group, Stranger and Telephone) collected at *Post*-conversation sampling times. Standard deviations are also indicated.

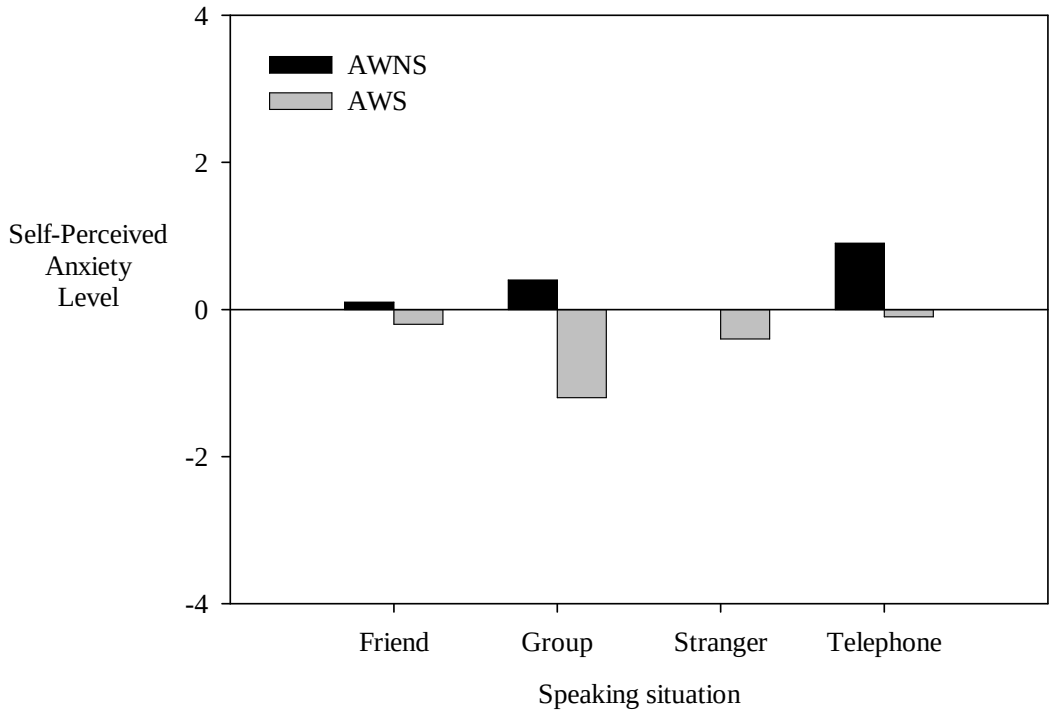


Figure 11: Difference in self reported anxiety levels between the Pre- and Post-conversation sampling for AWS and AWNS in different speaking situations (Friend, Group, Stranger and Telephone).

3.3 Correlational Analysis

In order to determine whether various relationships existed between cortisol levels, self reported anxiety levels and other speech-related factors, a series of Spearman correlations were calculated.

Cortisol and Self-perception. The results of the correlation analysis between cortisol and self-perception for AWS are shown in Table 9. Table 9 lists the correlations for both *pre*- and *post*-speaking situations. Results indicated three significant correlations, specifically between the *pre*-cortisol sample and the *pre*-self-perception rating with the Stranger (r = 0.59), between the *pre*-cortisol sample and the *pre*-self-perception rating on the Telephone (r = 0.57), and between the *post*-cortisol sample and the *post*-self-perception rating on the Telephone (r = 0.65).

Results of the correlation analysis between cortisol and self-perception for AWNS are presented in Table 10. Table 10 lists the correlation for both *pre*- and *post*-speaking situations. Results indicated no significant correlations between any of the variables for AWNS.

The overall results obtained from the cortisol analysis and self reported anxiety levels collapsed across all speaking situations for the *pre*-speaking situations. Results are depicted in Figure 12. Results indicated a significant correlation for AWS (r = 0.44), but not for the AWNS (r = -0.07).

As part of this analysis it was noted that one AWS participant seemed to be an outlier. Therefore, the correlation was re-calculated by removing this participant. The resultant correlation was still significant (r = 0.49), indicating that as a group, there was a tendency for increased cortisol to be associated with increased self reported anxiety levels. The correlation between self reported anxiety levels and cortisol levels with the removed AWS outlier is shown in Figure 13.

General results for the cortisol levels and self reported anxiety levels for the *post*-speaking situations are presented in Figure 14. Results demonstrated a significant correlation for AWS (r = 0.35), but not for the AWNS (r = 0.25).

	Self Fb	Self Fa	Self Sb	Self Sa	Self Gb	Self Ga	Self Tb	Self Ta
Cort Fb	0.14							
Cort Fa		0.00						
Cort Sb			0.59*					
Cort Sa				0.31				
Cort Gb					0.43			
Cort Ga						0.37		
Cort Tb							0.57*	
Cort Ta								0.65*

Table 9: Correlation matrix showing the relationship between cortisol levels (Cort) and self report anxiety (Self) in four different speaking situations in AWS. The speaking situation are speaking to a friend before (Fb) and after (Fa), speaking to a stranger before (Sb) and after (Sa), speaking to a group before (Gb) and after (Ga), and speaking on the telephone before (Tb) and after (Ta). *Correlations exceeding r=0.521 were significant at $p<0.05$ (Minium, 1978).

	Self Fb	Self Fa	Self Sb	Self Sa	Self Gb	Self Ga	Self Tb	Self Ta
Cort Fb	-0.11							
Cort Fa		0.27						
Cort Sb			0.35					
Cort Sa				0.27				
Cort Gb					0.00			
Cort Ga						0.02		
Cort Tb							0.04	
Cort Ta								0.23

Table 10: Correlation matrix showing the relationship between cortisol levels (Cort) and self report anxiety (Self) in four different speaking situations in AWNS. The speaking situation are speaking to a friend before (Fb) and after (Fa), speaking to a stranger before (Sb) and after (Sa), speaking to a group before (Gb) and after (Ga), and speaking on the telephone before (Tb) and after (Ta). *Correlations exceeding r=0.521 were significant at $p<0.05$ (Minium, 1978).

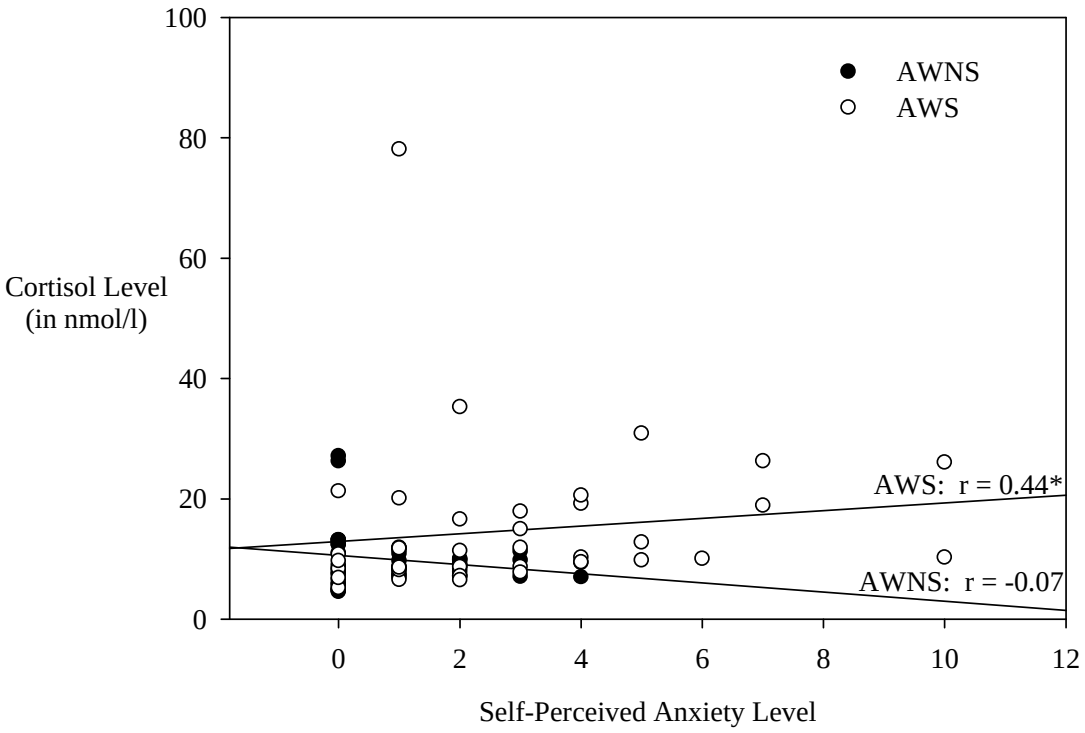


Figure 12: Correlation between self reported anxiety levels and cortisol levels in AWS and AWNS collapsed across all *pre*-speaking situations. *Correlations exceeding r=0.26 were significant at $p < 0.05$ (Minium, 1978).

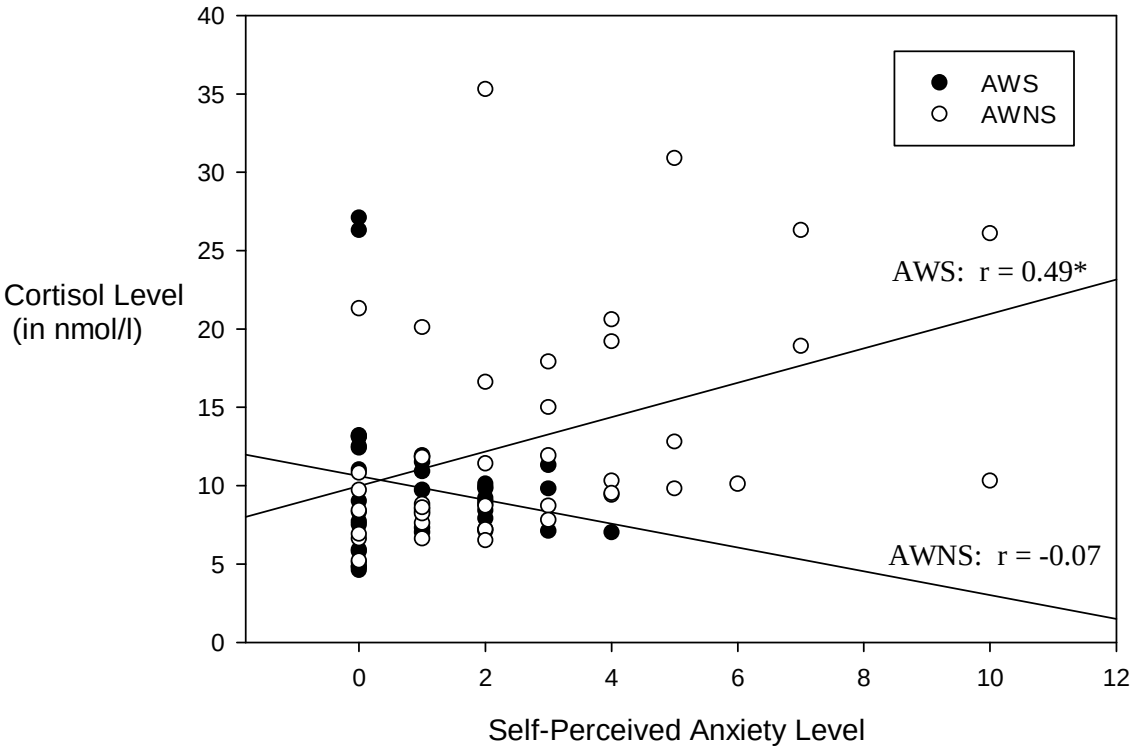


Figure 13: Correlation between self reported anxiety levels and cortisol levels in AWS and AWNS collapsed across all *pre*-speaking situations with one AWS outlier removed (AWS 6 in speaking situation Gb). *Correlations exceeding r=0.26 were significant at $p<0.05$ (Minium, 1978).

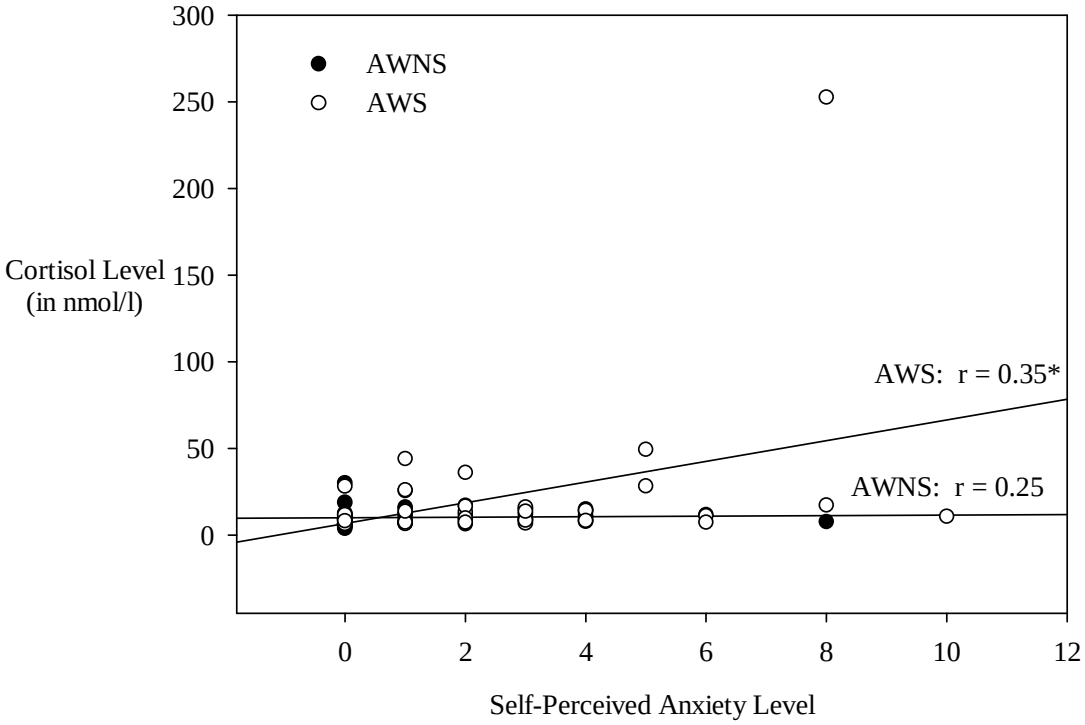


Figure 14: Correlation between self reported anxiety levels and cortisol levels in AWS and AWNS collapsed across all *post*-speaking situations. *Correlations exceeding r=0.26 were significant at $p<0.05$ (Minium, 1978).

As part of this analysis it was assessed that one AWS participant seemed to be an outlier. Therefore, the correlation was re-calculated by removing this participant. The resultant correlation was still significant (r = 0.30), indicating that as a group for the *post*-speaking situations, there was a tendency for increased cortisol to be associated with increased self reported anxiety levels. The correlation between self reported anxiety levels and cortisol levels with the removed AWS outlier is presented in Figure 15.

Self reported Anxiety Levels and Other Speech-Related Factors. The results of the correlation analysis between self reported anxiety levels based on different questionnaires and other speech-related factors for AWS are shown in Table 11. Results revealed four significant negative correlations, specifically severity in speaking situations *(CSS)* (Green, 1999) and years of stuttering *(YS)* (r = -0.61), stuttering severity *(SR)* and *YS* (r = -0.84), *OASES* (Yaruss & Quesal, 2006) and *YS* (r = -0.81), and *OASES COM* (Yaruss & Quesal, 2006) and *YS* (r=-0.53) indicating that the longer a person stutters the lower their rates were in *SR*, *OASES (COM)*, and *CSS*. Significant positive correlations were noted for *CSS* and *SR* (r = 0.80), *OASES* and *SR* (r = 0.91), *OASES COM* and *SR* (r = 0.67), *OASES* and *CSS* (r = 0.84), *OASES COM* and *CSS* (r = 0.75), and *OASES COM* and *OASES* (r = 0.81) indicating that high scores in self reported *SR* and *CSS*, are related to high scores on the *OASES* and its subtest.

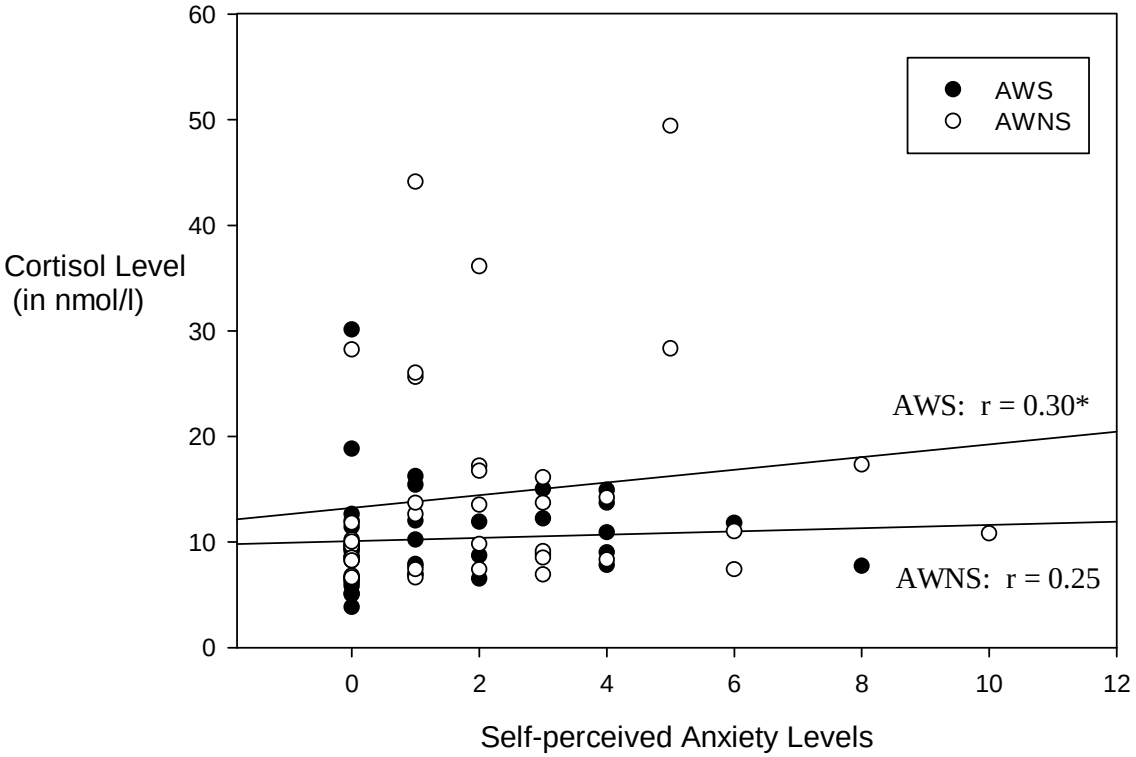


Figure 15: Correlation between self reported anxiety levels and cortisol levels in AWS and AWNS collapsed across all *post*-speaking situations with one AWS outlier removed (AWS 8 in speaking situation Ta). *Correlations exceeding r=0.26 were significant at $p<0.05$ (Minium, 1978).

CSS	1.00				
YS	-0.61*	1.00			
SR	0.80*	-0.84*	1.00		
OASES	0.84*	-0.81*	0.91*	1.00	
OASES COM	0.75*	-0.53*	0.67*	0.81*	1.00
	CSS	YS	SR	OASES	OASES COM

Table 11: Correlation matrix showing the relationship between self report anxiety based on questionnaires and other speech-related factors in AWS. The questionnaires are the Overall Assessment of the Speaker‘s Experience of Stuttering (OASES), and its subtest Communication in Daily Situations (OASES COM), the Communication Situation Scale (CSS), and other factors including years of stuttering (YS) and self report stuttering severity (SR). *Correlations exceeding r=0.521 were significant at $p<0.05$ (Minium, 1978).

3.4 Summary

In summary, the major findings of the present study are as follows:

1.) There was no significant difference between AWS and AWNS in cortisol levels in *pre*- and *post*-speaking situations.

2.) There was a significant difference between AWS and AWNS in self reported anxiety levels in *pre*-speaking situations. No group difference was evident in *post*-speaking situations.

3.) There was a significant relationship between cortisol level and self reported anxiety levels for AWS in both *pre*- and *post*-speaking situations.

4.) There were significant relationships between stuttering severity, years of stuttering and various communication attitude questionnaires.

4 Discussion

The purpose of the present study was to investigate relationships between cortisol levels and self reported anxiety levels in AWS and AWNS in various speaking situations. Based on cortisol measurements and self reported rating scales, three hypotheses were posed. They were: (1) AWS will significantly differ from AWNS in cortisol levels in varying speaking situations, (2) AWS will significantly differ from AWNS in self reported anxiety levels in varying speaking situations, and (3) Anxiety measurements of cortisol levels and self-perception will significantly positively correlate in varying speaking situations among AWS and AWNS. Results are discussed in reference to each of these hypotheses.

4.1 Cortisol Results

Results of the cortisol analysis indicated that AWS showed no significant difference in cortisol levels across each of the speaking situations. In addition, there were no significant changes in cortisol level when sampled immediately before and after each speaking situation. Similar findings were obtained for the AWNS group. On the basis of these results, Hypothesis I was rejected. Although AWS did not differ from AWNS across speaking situations, the cortisol levels in the *pre*-speaking Group situation were noticeably higher in the AWS group. The higher cortisol value for the AWS group was most likely due to an outlier (AWS 6), whose cortisol level was markedly higher (cortisol level=78.1nmol/L) in comparison to the remaining AWS participants. The normal level of cortisol found among normal healthy adults is between 4.0-17.0nmol/L (Lewis, unpublished data, 2010) (see Table 7).

A similar pattern was found for the *post*-speaking Telephone situation. As a group, the AWS revealed higher average cortisol levels than the AWNS. The likely reason for the higher cortisol results among the AWS can be attributed to participant AWS 8, whose cortisol measures in the Telephone situation were notably higher than the remaining AWS participants (cortisol level=252.71nmol/L) (see Table 7). The higher cortisol values for the Group and the Telephone situations for the AWS group are

also evident in the difference scoring between the *pre*- and *post*-speaking situation (see Figure 8). While it remains to be determined whether very personal and individual aspects of speech fluency or other external factors (e.g., fatigue or attention span on that day) contributed to the participant's elevated anxiety level, it is clear that the AWS 6 and AWS 8 participants had extremely high anxiety levels on these specific speaking tasks.

A variety of explanations are offered for the lack of overall difference between AWS and AWNS on measures of cortisol levels across the four speaking situations. Firstly, it seems likely there is no strong physiological component indicating higher anxiety levels in various speaking situations for both AWS and AWNS. This result contrasts with past literature that has shown a relationship between anxiety and cortisol. Specifically, Blood et al. (1994) found that cortisol responses for AWS were significantly higher during high-stress sessions than during baseline and low-stress sessions. These participants were sampled during self report instances of high stress (e.g., after an examination, a public speaking task), as well as at a low stress time. Blood et al. (1994) suggested that self report high-stress leads to higher cortisol responses. The present results are not directly comparable to those of Blood et al. (1994). Although these researchers looked at state anxiety, they considered a mix of various states, some of which included speaking situations. The current study was also concerned with state anxiety but it was exclusively confined to speaking situations (i.e., communication apprehension). In addition, there were differences in sampling procedures between the Blood et al. (1994) and the present study, such as imposing various restrictions prior to collecting saliva samples (e.g., no smoking, eating or drinking). A follow-up study from Blood et al. (1997) found that heightened cortisol levels correlated with participants scoring high on communication apprehension, regardless of whether they are AWS or AWNS. This finding would suggest that AWS do not differ from AWNS in their general physiological reaction to stress.

The second possible explanation for the lack of significance in cortisol levels across speaking situations in AWS and AWNS may be due to the manner in which anxiety

was physiologically measured (Menzies et al., 1999; Peters & Hulstijn, 1984). The present study measured cortisol as derived from samples of saliva. As such, salivette cortisol level measurement may not be sensitive enough to detect physiological changes associated with various speaking situations. Other ways of measuring cortisol that might be more precise include blood sampling or urine sampling (Levine et al. 2007), however, these are more invasive techniques. Although saliva cortisol determinations are ideally suited for non-invasive, stress-free and real time repeated sampling, the levels are usually about 10-fold lower than the total cortisol in circulation, which can be confounded by the presence of circulating high affinity binding proteins (Lewis, 2006). Generally, in clinical settings, plasma (blood) cortisol is the preferred medium for deriving cortisol levels (Gozansky, Lynn, Laudenslager & Kohrt, 2005; Lewis, 2006). It is interesting to consider that Francis (1979) tested 22 physical therapy students repeatedly over an academic term to find any correlations between mood and anxiety through different serum indicators such as uric acid, cortisol and cholesterol through blood analysis. They stated that changes in cortisol serums were strongly correlated with changes in anxiety over time in high-stress situations. It is possible that adding more serum indicators (e.g., acid urine or cholesterol) next to the salivette methodology would result in a more sensitive methodology to guarantee reliability on physical measurements, rather than relying on only one measurement (Francis, 1979; Menzies et al., 1999).

In addition, it is conceivable that man participants are not ideal candidates for measurement of anxiety. A case in point is the work of Schiefelbein and Susman (2006) in regard to sex differences and cortisol levels. These researchers examined a group of adolescents AWNS over a 6-month period and found differences in cortisol levels of women as an indicator of general and social anxiety. The same results were not found in their man counterparts. Therefore, it may be that cortisol changes are more sensitive in women compared to men. It is interesting to note that in the present group of participants at baseline levels there was a slight difference in values when examined according to sex group. The mean of the woman AWS was 11.77nmol/L and the man

AWS equivalent was slightly lower, 10.28 nmol/L. The same pattern of results was also shown for the woman AWNS, which had a mean of 8.75 nmol/L, while the man AWNS was 8.4 nmol/L. Thus, there seems to be a sight trend for woman AWS and AWNS to show slightly higher cortisol levels compared to men.

Other suitable ways of physiologically measuring anxiety include heart rate, vasomotor responses (using radial artery ultrasonography), perspiration rate, and electrodermal activity (on the skin) (Baumgartner & Brutten, 1983; Kraaimaat, Janssen, & Brutten, 1988). So it is possible that differences in cortisol levels across speaking situations, as well as between AWS and AWNS could have been identified if an alternative physiological measurement or simultaneous measurement of multiple systems were chosen (Menzies et al., 1999). However, there is evidence that alternative physiological measurements of anxiety may still indicate that there are no major differences in anxiety between AWS and AWNS. Peters and Hulstijn (1984) tested 48 AWS and AWNS in different speaking situations (reading silent, reading aloud and speaking to the researcher in a face-to-face conversation), as well as in non-speaking situations (motor & intelligence tasks) according to verbal apprehension and physiologic activity. Anxiety was physiologically measured by spontaneous fluctuations in skin conductance, pulse volume, and heart rate, before, during, and after the tasks. The researchers found that the physiological levels for both AWS and AWNS were higher before and during speaking tasks than in comparison to physiological arousal before and during non-speech related tasks, but no group differences between AWS and AWNS could be found. Weber and Smith (1990) failed to find significant group differences in AWS and AWNs in two non-speech related and two speech-related tasks when measured according to electrodermal activity, peripheral blood flow, and heart rate. Thus, it could be concluded that that physiological measurements of state anxieties may be relatively insensitive to differentiate AWS from AWNS.

Another explanation to account for rejecting Hypothesis I concerns the environmental settings used in the present study and the timeline for collecting cortisol samples. Each participant was sampled over five consecutive days and provided with a 24-hour

"pre-warning" as to the speaking situation they would be engaged in during the next day. In addition, collection of *pre*-speaking and *post*-speaking cortisol samples was separated by a time space of approximately 30-minutes. The 30-minute gap was chosen based on clinical tests on stress responses involving the hypothalamic-pituitary-adrenal axis (a complex set of interactions among the hypothalamus, the pituitary gland and the adrenal glands), which indicate that the 30-minute window following stimulation results in optimal cortisol changes in either blood or saliva (Gozansky, Lynn, Laudenslager & Kohrt, 2005). It is possible that the 24-hour "pre-warning" was insufficient in evoking a high level of anxiety from the AWS participants. Furthermore, the environmental settings were somewhat "contrived" and may have been similarly insufficient in evoking a high level of anxiety (Menzies et al., 1999). For example, speaking in front of a large group of people could have a stronger effect than only speaking in front of a small group of four listeners (Young, 1965; Siegel & Haugen, 1964). Research by Siegel and Haugen (1964) showed that the increase of audience size tended to have effects on stuttering frequency. However, Young (1965) found that no systematic effect of higher frequency and severity of stuttering occurred when changing the audience size from one to four listeners, specifically when the AWS did not have prior knowledge or expectations about the audience size.

A final explanation to account for rejecting Hypothesis I concerns the involvement of the majority of the AWS in any kind of previous or current treatment program. Three of the ten AWS (AWS 8, 9, & 10) participants in the present study were currently in treatment at the time of data collection. The remaining seven AWS participants had been in different previous treatments. Craig (1990) stated that trait anxiety levels in AWS decreased to within normal levels following intensive treatment of stuttering. The simple act of receiving treatment for stuttering may have an additional benefit of reducing any speech-associated anxiety. Unfortunately, the study of Craig (1990) did not measure changes in state anxiety (e.g., communication apprehension) after treatment to compare with pre-treatment levels. Further, it is interesting to consider that the results for the younger participants in the AWS group (AWS 8, 9 & 10) were

found to show higher cortisol levels in general across all speaking situations than their older counterparts, and in comparison to the younger AWNS group (see Table 7). While it remains to be determined whether prior stuttering treatment has an impact on state anxiety levels, it is intriguing to consider that there is a relationship between years of stuttering and anxiety levels (see 4.3).

4.2 Self-Perception Results

Results obtained for the AWS and AWNS participants in their self-perception of anxiety for the four pre-speaking situations indicated significant group differences. Across the AWS participants, their self report anxiety was significantly higher immediately before speaking to a Group compared to speaking to a Friend, speaking to a Stranger compared to speaking to a Friend, and speaking on the Telephone compared to speaking to a Friend. A similar pattern was found when the data for AWS and AWNS were combined, however no such differences in self report anxiety were found for the AWNS group alone. Therefore, Hypothesis II can be accepted for the *pre*-speaking situations. The results for the *post*-speaking situations in self-perception showed no significant difference between the AWS and AWNS group. Therefore Hypothesis II is rejected for the *post*-speaking situation.

Two interpretations are offered as to why the AWS participants‘ self report anxiety was significantly higher for some situations compared to others during the *pre*-speaking sampling. First, it is important to recognize that a large body of research confirms that state anxiety (e.g., communication apprehension) is higher in AWS than in AWNS (Craig, 1990; Craig et al., 2008; Ezrati-Vinacour & Levin, 2004; Gabel et al., 2002; Kraaimaat et al., 2002; Lincoln et al., 2002; Mulcahy et al., 2008). For example, Craig (1990) found that AWS show higher state anxiety in demanding speaking situations (such as speaking on the Telephone), suggesting that state anxiety increases due to the belief that speech is erratic and threatening (Miller & Watson, 1992). Messenger et al. (2004) found that AWS experience higher levels of state anxiety than AWNS, especially when social harm is expected. Davis et al. (2007) administered question-

naires assessing trait and state anxiety in (adolescent) AWS and AWNS, as well as in recovered (adolescent) AWS in different speaking situations. They found a significant group difference between AWS and AWNS for (1) Speaking to a stranger in a shop, (2) Talking to a friend on the telephone, (3) and speaking in front of a class. No such group differences were found for talking face-to-face with a group of friends. In general, the results of the present study agree with past studies indicating that AWS have higher levels of self report communication apprehension compared to AWNS.

A second interpretation of the results obtained for the *pre*-speaking situation relates to the results obtained for the "Friend" situation. Closer inspection of the results indicate that significant differences in AWS were only found between the speaking situation "Friend" compared to all of the other speaking situations (Group, Telephone, & Stranger). This finding seems to suggest that once an AWS is out of his/her "comfort zone" with a familiar listener, self report anxiety is equally high for any kind of speaking situation. This finding would appear to conflict with some of the early research on stuttering anxiety and self-perception. For example, Steer and Johnson (1936) examined the relationship between the amount of stuttering and the emotional/psychological reactions in various speaking situations (e.g., speaking aloud alone, with/without time pressure, with different audience sizes and types, and on the telephone). Steer and Johnson (1936) suggested that the most dysfluencies occur "in situations in which the audience was unfamiliar, or indefinite [...], or relatively large (two to at least eight persons)" (p. 42). That is, the lowest rates of dysfluency were associated with speaking to a familiar person with an increase in stuttering gradually rising with the unfamiliarity and size of the audience. The researchers concluded that the amount of stuttering is directly associated with emotional and psychological reactions of stuttering. Although the present study did not examine frequency of stuttering, the results appear do not agree with those of Steer and Johnson as the self reported anxiety levels did not rise with an increase in size. However, they did increase with unfamiliarity of the listeners. Rather, there was no difference in self report anxiety between Stranger, Group, and Telephone. These results are supported by Young (1965) who found that the actual size

of the group, whether it is only one or four listeners, does not influence anxiety levels. In addition Gabel et al. (2002) and Lerman and Shames (1965) found no difference within different speaking situations in communication apprehension. Thus, it would appear that the most comfortable (self reported) speaking situation is with a friend. All other speaking situations are perceived to result in higher anxiety.

Examination of the results obtained for the *post*-speaking situations indicate that self-perception levels decreased for AWS, while a gradual increase was found for the AWNS across all speaking situations (see Table 7). This would suggest that the AWS demonstrated lower levels of anxiety after fulfilling different speaking tasks compared to immediately before. The reverse pattern was found for the AWNS group. It is of interest to note that most past studies examining self-perception of stuttering have not sampled AWS/AWNS before and after different speaking tasks (Craig, 1990; Davis et al., 2007; Mulcahy, Hennessey, Peters & Hulstijn, 1984). In the present study, by performing *pre*- and *post*-samples, noticeable differences were found. Therefore, it would seem that results obtained in past studies may need to be reconsidered based on the method in which judgments of self report anxiety were obtained. While it seems reasonable that the AWS self report anxiety would decrease after performing the speaking task, due simply to a sense of relief or anticipation effect, it is unclear why the AWNS anxiety levels increased. It is possible that the contrived nature of the speaking situations may have been more difficult for the AWNS than expected. For example, asking the AWNS to speak on the telephone to make a fictitious travel enquiry may have been particularly challenging. However, this type of speaking task is routinely used as part of stuttering treatment, so that most of the AWS with previous treatment experience may have been more familiar with the type of contrived speaking task than the AWNS.

Across all *pre*- and *post*-speaking situations it was evident that woman AWS tended to rate their anxiety levels higher than man AWS. Therefore an additional (albeit exploratory) post-hoc analysis of possible sex differences was performed. Results of an unpaired t-test indicated significant differences between woman and man AWS [t =

2.88, $p<0.005$]. The mean for all self report speaking situations in woman AWS was 3.5 (SD = 3.30), while the mean for the man AWS was 1.9 (SD = 1.63). The observed sex difference between the AWS speakers runs counter to the findings of Craig (1990), who reported no sex differences in communication apprehension for a group of AWS participants. Craig did not critically examine self-perception across various speaking situations. In the present study, four different speaking situations were examined. The collective findings of the present study would seem to suggest a sex difference among AWS in their self report anxiety.

4.3 Correlational Analysis

Results of the correlation analysis showed significant positive correlations between cortisol levels and self report anxiety for the AWS group in both pre- and post-speaking situations (see Figure 12 & Figure 14). Therefore, Hypothesis III is accepted for the AWS group. No such correlations were evident for the AWNS group (see Figure 13 & Figure 15). Further statistical analysis across the four different speaking situations indicated significant correlations between cortisol levels and self report anxieties when (1) Talking to a Stranger in the pre-speaking situation, (2) Talking on the Telephone in the pre-speaking situation, and (3) Talking on the Telephone in the post-speaking situation. It is likely these speaking situations were the most challenging for the AWS group and were the primary situations that resulted in the overall group differences (collapsed across all speaking situations). These results contrast with previous research of Blood et al. (1997), who found significant correlations between self report communication apprehension and cortisol levels for both AWS and AWNS groups, while the present study only found this relationship for the AWS group. The results of the present study also contradict the findings of Dietrich and Roaman (2001) who found no significant correlation between self-judgment and physiological arousal. These researchers measure skin conductance rather than cortisol so it could be that skin conductance is not sensitive enough to detect physiological changes as well as cortisol.

It is unclear why cortisol levels alone were not found to differ across the four speak-

ing situations between AWS and AWNS, but once cortisol levels were examined in relationship to self report anxiety a significant correlation in both *pre-* and *post*-speaking situations for the AWS group could be observed. That is, cortisol as a "stand alone" measure was not sensitive to detect differences in anxiety levels across speaking situations. However, once cortisol values were paired with self-perception values, a clear relationship was found for AWS. No such relationship was found for the AWNS group.

There has been limited research examining the relationship between cortisol levels and self-perception of anxiety in stuttering. Blood et al. (1994) measured self reported anxiety levels with two self-report inventories such as the State-Anxiety Inventory *(SAI)* (Spielberger, 1983), and the Personal Report of Communication Apprehension *(PRCA)* (McCroskey, 1978, 1985), and compared these to salivary cortisol levels in high- and low-stress situations. Blood et al. (1994) found no interrelationship between cortisol levels and state or communication apprehension scores, which contrasts with the result of the present study. In addition, Peters and Hulstijn (1984) examined the relationship between subjective measures of anxiety in comparison to physiological activity in AWS. The researchers measured physiological activity with heart rate, vasomotor responses, and electrodermal activity prior and after speaking and non-speech related tasks. The subjective anxiety associated with each task was measured using a 5-point rating scale. Peters and Hulstijn (1984) found no significant relationship between the subjective and physiologic measures of anxiety. The primary difference between the Blood et al. (1994) and the Peters and Hulstijn (1984) studies compared to the present study, relates to the manner in which speech anxiety was assessed. These past studies did not adequately considered a variety of speaking situations. As such, the subjective measure of speaking anxiety was not critically evaluated. The present study considered four different speaking situations, which were found to correlate with corresponding cortisol levels. self report anxiety measurements have been found to be a strong and robust measure of anxiety in previous research (Mulcahy et al., 2008; Davis et al., 2007; Ezrati-Vinacour & Levin, 2004; Messenger et al., 2004; Kraaimaat et al., 2002; Miller & Watson, 1992; Craig, 1990), while measuring cortisol seems to have a lower impact.

Nevertheless, the combination of both measures appears to provide evidence of a link between a PWS self report anxiety and their actual physiological response to anxiety.

In order to explore various relationships between cortisol levels, self reported anxiety levels and other speech-related factors, a series of further correlations were performed. Two of the noteworthy correlations were: (1) an age effect, and (2) a stuttering severity effect. Firstly, an age effect across the range of participants between 19 to 62 years occurred with negative correlations between years of stuttering since onset *(YS)* and general stuttering severity *(SR)*, *YS* and self report SR in specific speaking situations (CSS), YS and general views and reactions of stuttering *(OASES)* (Yaruss & Quesal, 2006), as well as in its subtest *(OASES COM)* (Yaruss & Quesal, 2006). These results would seem to indicate that the longer a person stutters the more likely their communication apprehension would decrease compared to a younger AWS. These results contrast with previous research of Bricker-Katz, Lincoln, and McCabe (2010). The researchers found upon interviewing 11 AWS over 55 years of age that "older" people who stutter experience fear of speaking in different situations, especially talking on the telephone, in comparison to qualitative data from younger AWS. Bricker-Katz et al. (2010) did not ask about experiences in specific speaking situations and measures were not taken before, during or after those situations such as in the present study. It may be that the "older" AWS have a longer history of being exposed to (difficult) speaking experiences, which is has the result of lowering self reported anxiety levels. It is intriguing to consider the influence of long-term chronic stuttering on self report anxiety. It might be that anxiety plays a slightly diminished role in daily life when it comes to talking in various speaking situations of older AWS compared to younger AWS.

Stuttering severity was positively correlated with self-perception in various speaking situations, as well as on self-reported questionnaires such as the *CSS* (Green, 1999), the *OASES*, and *OASES COM* (Yaruss & Quesal, 2006). High stuttering severity (on a scale from 1-10) as rated by the AWS, was also associated with high scores on the *CSS*, *OASES* and the *OASES COM* subtest. These correlations indicate a

strong relationship between self report stuttering severity and anxiety associated with communication and the impact of stuttering on the AWS life. These results agree with past research indicating that high stuttering severity (classified as severe stutterers) is strongly linked to high communication apprehension (Caruso et al., 1994; Craig et al., 2003; Ezrati-Vinacour & Levin, 2004; Lincoln et al., 1996; Miller & Watson, 1992; Peters & Hulstijn, 1984; Vanryckeghem & Brutten, 1996; Weber & Smith, 1990).

4.4 Telephone anxieties and phobias in stuttering

Perhaps the most often cited situation that is problematic for AWS is the telephone. Some of the problems reported include (1) communicative stress and high levels of fear (Georgieva, 1994; Kehoe, 1998; Leith & Timmons, 1983a & 1983b; Silvermann, 1997; Zimmermann et al. 1997; Resick et al., 1978), (2) higher stuttering frequency (Ladoucer et al., 1982; Resick et al., 1978), and (3) avoidance-behaviour (James et al., 1999). One of the earliest studies to consider the relationship between stuttering and telephone use was by Steer and Johnson (1936). They reported speaking on the telephone with different listeners as one of the most difficult speaking situations for AWS.

Davis et al. (2007) noted significantly higher trait and state anxiety levels in (adolescent) AWS when talking to a friend on the telephone in comparison to talking to a group of friends in a face-to face conversation. Ormond (1981) examined the attitudes of AWS when talking to AWS and AWNS on the telephone while making and receiving telephone calls. The results showed that AWS were more fluent when talking to another AWS on the telephone compared to talking to an AWNS. She also found that using the telephone is a feared speaking situation among many AWS, although this was not statistically demonstrated.

Perhaps the most comprehensive study to date regarding telephone fears of AWS was completed by James et al. (1999). These researchers surveyed a large group of AWS and the majority reported that using the telephone was one of the most challenging speaking situations compared to "face-to-face" conversation because of (1) the total

reliance or focus on speech, (2) the inability to use nonverbal communication, (3) the lack of visual feedback from the communication partner, (4) the impersonal nature of telephone talk, and (5) higher time pressure. Moreover, James et al. (1999) reported that making a telephone call is more difficult than answering one. They also found an age difference in regard to telephone use by AWS. For example, avoidance-like behaviour was more prevalent among younger AWS than their older counterparts. It is also interesting to consider the findings of Rami, Kalinowski, Stuart, and Rastatter (2003), who evaluated self reported anxiety levels of 29 speech-language pathology students before and after pseudostuttering on the telephone. Results indicated that participants perceived themselves as significantly more afraid and anxious after having completed this speaking experience, which would suggest that even pseudostuttering has an impact on self-perceptions and anxiety.

Speaking on the telephone is a daily life situation which has historically been known to be more problematic for AWS in comparison to other speaking situations. In the present study, it was assumed that this situation would create the highest level of anxiety. The combined results from the cortisol and self-perception analysis revealed that anxiety associated with telephone use was not consistently associated with the highest level of anxiety. A notable finding from the telephone results was a high level of inter-subject variability among the AWS participants for both the cortisol and self-perception measures (Menzies et al., 1999). In some participants, use of the telephone was no less problematic than other speaking situations (e.g., AWS 2, 4, 5, 6 & 7). On the other hand, use of the telephone appeared to be very problematic for some of the participants, in particular AWS 1, 3 and 8. Social phobia is described as a complex prevalent and disabling anxiety disorder with fears of specific situations (e.g., speaking in public) with co-existing pervasive anxieties about different social interactions (Myers, Weissman, Tischler, Holzer, Leaf, Orvaschel, et al., 1984; Turner, Beidel, Dancu, & Keys, 1986). Use of the telephone in AWS seems to be one such social phobia. However, because of the complex structure of social phobias, it is perhaps not surprising to find high inter-individual variability in performance on this task.

5 Limitations

Although the results of the present study appear to indicate a relationship between cortisol levels and self reported anxiety levels in AWS which is not apparent in AWNS, there are some limitations to this study that need to be considered. For example, the sample size of ten participants was not large, thereby limiting the applicability of results to a wider population of AWS. It is possible that a larger participant sample would have yielded more sensitive salivary cortisol results. The sample size contributed to low statistical power in regard to possible sex differences on cortisol measures, as well as self-perception questionnaires (Jones, Gebski, Onslow, & Packman, 2002; Menzies et al., 1999). There was a trend towards a sex and age difference within the AWS group on various measures, but these could not be fully confirmed.

The method of cortisol sampling may have also influenced the present results. The cortisol samples were taken after providing each participant with a 24-hour "pre - warning" notification. It was assumed this form of notification would result in enhanced levels of anxiety for each speaking situation. However, this advanced notification could have allowed the participants to ready themselves for the upcoming speaking tasks. Perhaps collecting the cortisol measures without a "pre-warning", would have further raised their anxiety levels, which would have altered the results in showing other tendencies and relationships. Moreover, more baseline samples, before as well as after, fulfilling the different speaking situations would have been helpful to gain more stable results across the sampling times. In addition, the setting used for each speaking situation was the same (i.e., clinic room). The use of more natural environmental settings may have yielded different results.

It was not possible to control for the stressors of daily life that each participant may have experienced during the one-week sampling period of data collection. As such, some participants may have shown higher/lower levels of anxiety simply as a result of their experiences over the 24-hour period (e.g., traffic jams etc.). Furthermore, additional external factors such as diet and sleep pattern were not controlled and therefore may have had an influence on the results (Björbtorp, 2000; Blood et al.,

1994, 1997; Hammerfald et al., 2005). In the present study, tight control was placed on the exact time of sampling each day so as allow for comparisons across participants. This methodology allows for the study to be replicated in other laboratories.

Another limitation to the present study relates to the influence of stuttering treatment. The study did not control for the presence or absence of stuttering treatment, or the type of treatment received. Daily experiences with different challenging speaking tasks have an impact on anxieties and fears and guided exposure to certain situations is also used in stuttering treatment (Menzies et al., 1999). It could be observed in the present study that the younger AWS showed elevated anxiety levels on some speaking situations (e.g., telephone) compared to older AWS. So it is possible that the older AWS showed lower anxiety levels as a result of a longer history of receiving treatment for their stuttering.

6 Clinical Implications

Although results of the present study did not directly address matters concerning assessment and treatment of anxiety in stuttering, results within the AWS group have clearly shown that elevated self reported anxiety levels (i.e., communication apprehension) is a prevalent issue (Craig, 1990; Gabel et al., 2002; Messenger et al., 2004; Miller & Watson, 1992). Even if cortisol measures could be an objective alternative measurement in stuttering assessment and treatment, self-perception as an anxiety measurement seems to be more stable and reliable with a higher practicability such as lower costs, better availability, and less time consumption. Furthermore, results of this study indicate that using self-rating scales addressing specific speaking situations in *pre-* and *post*-performing speaking tasks are more accurate for clinical use than just assessing anxiety through general questionnaires (e.g., *STAI*; Spielberger, 1983). Self-rated scales (e.g., Erickson Modified 24 Scale; Andrews & Cutler, 1974, or the Speech-related anxiety questionnaire; Dietrich & Roaman, 2001) are useful for documenting clinical progress of anxiety related to speaking situations. The Camperdown Program for AWS (O'Brian, Carey, Onslow, Packman & Cream, 2009) uses a 5-point self-rating anxiety scale before and after fulfilling speaking tasks, such as talking in front of a group of people. While the application of cortisol measurement and self-rating scales would likely provide insight into both the self report and actual physiological effects of stress associated with treatment outcomes, it has to be emphasized that cortisol sampling as a "stand-alone" measurement does not appear to provide sufficient sensitivity to assess anxiety levels in AWS.

Further, anxiety management should be also integrated in fluency treatment programs, as results of the present study have shown that there is an anticipation effect between the *pre-* and *post-* speaking situations in AWS. Exposing an AWS to difficult speaking situations (e.g., making a telephone call) reduces in the long-term their anxiety. Therefore, it is not just sufficient to learn a new speaking technique, but also to integrate this technique (e.g., systematic exposure to difficult speaking situations).

7 Future Research

Menzies et al. (1999) stated that "an ambiguous literature on the role that anxiety plays in the condition impairs clinical practice and retards the development of novel clinical procedures. Until the precise nature of the relationship between anxiety and stuttering is not understood, fully appropriate treatment [...in] adult stuttering cannot be offered" (p. 8). Further research, between the relationship of stuttering (severity) and anxiety is necessary. While the present study only addressed self report stuttering ratings, the influence of stuttering severity (frequency and quality of stuttering) in different speaking situations should be considered. Measures such as those established by the Lidcombe Behavioural Data Language (Packman & Onslow, 1998) or the stuttering severity instrument *(SSI)* (Riley, 1972) could be explored to better understand the relationship between stuttering severity and anxiety. While past literature seems to confirm that stuttering severity increases with anxiety levels (Ezrati-Vinacour & Levin, 2004; Miller & Watson, 1992; Mulcahy et al., 2008; Weber & Smith, 1990), these studies have failed to compare stuttering severity with anxiety levels in different speaking situations.

In the present study two interesting findings could be observed (1) an age-effect and (2) a sex-effect. Research considering chronic stuttering, as well as life-long use of various treatment techniques and their relationship to communication apprehension is an unexplored area. This kind of research would have a major impact on evidenced-based outcome studies of various treatment programs when it comes to negative emotions associated with previous speaking experiences and whether it is possible to diminish communication apprehension and fear of speaking. It would be of high interest, to show that with specific stuttering programs communication apprehension is lowered at post-treatment, as well as at follow-up treatment sampling times when comparing young vs. older AWS. On the other hand, research addressing sex differences and communication apprehension would have an enormous influence on the design and structure of stuttering therapy. If woman AWS do indeed show higher physiological, as well as self-judgmental anxiety levels, the implication of anxiety reduction strategies in stut-

tering treatment with woman AWS are much more essential than what was previously assumed (Craig, 1990; Schiefelbein & Susman, 2006). Therefore, more studies focusing on sex differences would be necessary for efficient stuttering treatment.

8 Conclusion

In the present study, no significant differences were found in communication apprehension across four different speaking situations between AWS and AWNS when measured according to salivary cortisol levels. A significant difference was found in self reported anxiety levels in *pre*-speaking situations between AWS and AWNS. The AWS group differed in their self report communication apprehension when speaking with a Friend compared to all other speaking situations. All remaining speaking situations were rated highly by AWS. The combined results of the cortisol and self-perception analysis indicated a significant relationship between the two variables for the AWS. Therefore, it appears that cortisol as a "stand-alone" measure is not sufficiently sensitive to detect elevated communication apprehension in speaking situations. However, once this measure is paired with self-perception results, there appears to be a corresponding physiological link to communication apprehension among AWS. Thus, it is concluded that a difference in communication apprehension exists between AWS and AWNS when it comes to speaking in a variety of situations.

References

Alm, P. A. (2004). Stuttering, emotions, and heart rate during anticipatory anxiety: a critical review. *Journal of Fluency Disorders, 29*(2), 123-133.

Ammons, R., & Johnson, W. (1944). Studies in the psychology of stuttering: XVIII. The construction and application of a test of attitude toward stuttering. *Journal of Speech Disorders, 9*, 39-49.

Andrews, G., & Cutler, J. (1974). Stuttering therapy: The relation between changes in symptom level and attitudes. *Journal of Speech and Hearing Disorders, 39*(3), 312.

Andrews, G., Hoddinott, S., Craig, A., Howie, P., Feyer, A., & Neilson, M. (1983). Stuttering: A review of research findings and theories circa 1982. *Journal of speech and hearing disorders, 48*(3), 226.

Baucom, J. A. (1995). *An exploratory study of public speaking anxiety and audience familiarity.* 55, ProQuest Information & Learning, US. Retrieved from http://search.ebscohost.com/login.aspx?direct=true&db=psyh&AN=1995-95003-059&site=ehost-live Available from EBSCOhost psyh database.

Baumgartner, J. M., & Brutten, G. J. (1983). Expectancy and heart rate as predictors of the speech performance of stutterers. *Journal of Speech & Hearing Research, 26*(3), 383-388.

Beck, A., Epstein, N., Brown, G., & Steer, R. (1988). An inventory for measuring clinical anxiety: Psychometric properties. *Journal of consulting and clinical psychology, 56*(6), 893-897.

Beck, A. T. (1972). Measuring depression: The depression inventory. In T. Williams, M. Katz & J. Shields (Eds.), *Recemt advamces in the psychobiology of the depressive illnesses* (pp. 299-302). Washington, DC: U.S. Government Printing Office.

Bennett, E. M. (2006). *Working with people who stutter: a lifespan approach*. Upper Saddle River, N.J.: Pearson Merrill/Prentice Hall.

Björntorp, P., & Rosmond, R. (2000). Obesity and cortisol. *Nutrition, 16*(10), 924-936.

Blood, G. W., Blood, I. M., Bennett, S., & Simpson, K. C. (1994). Subjective anxiety measurements and cortisol responses in adults who stutter. *Journal of Speech & Hearing Research, 37*(4), 760-768.

Blood, G. W., Blood, I. M., Frederick, S. B., Wertz, H. A., & Simpson, K. C. (1997). Cortisol responses in adults who stutter: Coping preferences and apprehension about communication. *Perceptual and Motor Skills, 84*(3, Pt 1), 883-889.

Blood, G. W., Blood, I. M., Maloney, K., Meyer, C., & Qualls, C. D. (2007). Anxiety levels in adolescents who stutter. *Journal of Communication Disorders, 40*(6), 452-469.

Blood, G. W., Blood, I. M., Tellis, G., & Gabel, R. (2001). Communication apprehension and self-perceived communication competence in adolescents who stutter. *Journal of Fluency Disorders, 26*(3), 161-178.

Bloodstein, O. (1958). Stuttering as an anticipatory struggle reaction. In J. Eisenson (Ed.), *Stuttering: A symposium*. New York: Harper & Row.

Bloodstein, O. (1975). Stuttering as tension and fragmentation. In J. Eisenson (Ed.), *Stuttering: A second symposium* (pp. 1-95). New York: Harper & Row.

Bloodstein, O., & Ratner, N. B. (2008). *A handbook on stuttering* (6th ed.). Clifton Park, NY: Thomson Delmar Learning.

Bray, M., & James, S. (2009). An evaluation of a telephone assistive device (TAD) for people who stutter. *International Journal of Speech-Language Pathology, 11*(1), 54-60.

Bricker-Katz, G., Lincoln, M., & McCabe, P. (2010). Older people who stutter: barriers to communication and perceptions of treatment needs. *International Journal of Language & Communication Disorders, 45*(1), 15-30.

Brutten, E. J., & Shoemaker, D. J. (1967). *The modification of stuttering*. Englewood Cliffs, N.J.,: Prentice-Hall.

Brutten, G. (1973). Behaviour assessment and the strategy of therapy. In Y. Lebrun & R. Hoops (Eds.), *Neurolinguistic Approaches to Stuttering*. The Hague: Mouton & Co.

Brutten, G. (1975). Stuttering: Typography, assessment, and behavior change strategies. In J. E. (Ed.) (Ed.), *Stuttering: A Second Symposium*. New York: Harper and Row.

Brutten, G., & Janssen, P. (1981). A normative and factor analysis study of the responses of Dutch and American stutterers to the Speech Situations Checklist. *Proc 18th Congr Int Assoc Logop Phoniatr, Washington*, 469-478.

Brutten, G. J., & Shoemaker, D. J. (1970). Additional comments on 'The modification of stuttering.'. *Journal of Communication Disorders, 3*(1), 68-75.

Caruso, A., Chodzko-Zajko, W., Bidinger, D., & Sommers, R. (1994). Adults who stutter: Responses to cognitive stress. *Journal of Speech and Hearing Research, 37*(4), 746.

Cattell, R. (1966). Anxiety and motivation: Theory and crucial experiments. *Anxiety and behavior, 1*, 23-62.

Clare, T. S., Menzies, R. G., Onslow, M., Packman, A., Thompson, R., & Block, S. (2009). Unhelpful thoughts and beliefs linked to social anxiety in stuttering: Development of a measure. *International Journal of Language & Communication Disorders, 44*(3), 338-351.

Commodore, R. (1980). Communicative stress and stuttering frequency during normal, whispered and articulation-without-phonation speech modes: A further study. *Human Communication, 5*, 143-150.

Commodore, R., & Cooper, E. (1978). Communicative stress and stuttering frequency during normal, whispered, and articulation-without-phonation speech modes. *Journal of Fluency Disorders, 3*(1), 1-12.

Conture, E. G. (1990). *Stuttering* (2nd ed.). Englewood Cliffs, N.J.: Prentice Hall.

Conture, E. G., & Curlee, R. F. (2007). *Stuttering and related disorders of fluency* (3rd ed.). New York: Thieme.

Craig, A. (1990). An investigation into the relationship between anxiety and stuttering. *Journal of Speech & Hearing Disorders, 55*(2), 290-294.

Craig, A., Blumgart, E., & Tran, Y. (2009). The impact of stuttering on the quality of life in adults who stutter. *Journal of Fluency Disorders, 34*(2), 61-71.

Craig, A., Hancock, K., Tran, Y., & Craig, M. (2003). Anxiety Levels in People Who Stutter: A Randomized Population Study. *Journal of Speech, Language, and Hearing Research, 46*(5), 1197-1206.

Davis, S., Shisca, D., & Howell, P. (2007). Anxiety in speakers who persist and recover from stuttering. *Journal of Communication Disorders, 40*(5), 398-417.

De Nil, L. F., & Brutten, G. J. (1990). Speech-associated attitudes: Stuttering, voice disordered, articulation disordered, and normal speaking children. *Journal of Fluency Disorders, 15*(2), 127-134.

Dietrich, S., & Roaman, M. (2001). Physiologic arousal and predictions of anxiety by people who stutter. *Journal of Fluency Disorders, 26*(3), 207-225.

Dixon, C. C. (1955). Stuttering adaptation in relation to assumed level of anxiety. In W. Johnson & R. R. Leutenegger (Eds.), *Stuttering in children and adults* (pp. 181-188). Minneapolis: University of Minnesota Press.

Endler, N., & Parker, J. (1990). Stress and anxiety: Conceptual and assessment issues. *Stress Medicine, 6*(3), 243-248.

Ezrati-Vinacour, R., & Levin, I. (2004). The relationship between anxiety and stuttering: A multidimensional approach. *Journal of Fluency Disorders, 29*(2), 135-148.

Fitzgerald, H., Djurdjic, S., & Maguin, E. (1992). Assessment of sensitivity to interpersonal stress in stutterers. *Journal of Communication Disorders, 25*(1), 31-42.

Francis, K. T. (1979). Psychologic correlates of serum indicators of stress in man: A longitudinal study. *Psychosomatic Medicine, 41*(8), 617-628.

Freud, S. (1936). *Hemmung, Symptom und Angst*: The Psychoanalytic Quarterly Press and WW Norton & Company, Inc.

Gabel, R. M., Colcord, R. D., & Petrosino, L. (2002). Self-reported anxiety of adults who do and do not stutter. *Perceptual and Motor Skills, 94*(3,Pt1), 775-784.

Garrod, O. (1958). The Pharmacology of Cortisone, Cortisol (Hydrocortisone) and their New Analogues. *Postgraduate Medical Journal, 34*(392), 300-304, 309.

Georgieva, D. (1994). Speech situations increasing stuttering by 13-16 year old persons. In C. W. Starkweather & H. F. M. Peters (Eds.), *Stuttering: Proceedings from the First World Congress on Fluency Disorders* (pp. 259-263). Nijmegen, The Netherlands: University Press Nijmegen.

Gozansky, W., Lynn, J., Laudenslager, M., & Kohrt, W. (2005). Salivary cortisol determined by enzyme immunoassay is preferable to serum total cortisol for assessment of dynamic hypothalamic–pituitary–adrenal axis activity. *Clinical endocrinology, 63*(3), 336-341.

Gray, B., & Brutten, E. (1964). The relationship between anxiety, fatigue and spontaneous recovery in stuttering. *Behaviour Research and Therapy, 2*(2-4), 251-259.

Green, T. (1999). The relationship of self-conception to perceived stuttering severity in children and adults who stutter. *Journal of Fluency Disorders, 24*(4), 281-292.

Guitar, B. (2006). *Stuttering : an integrated approach to its nature and treatment* (3rd ed.). Baltimore: Lippincott Williams & Wilkins.

Hahn, E. F. (1940). A study of the relationship between the social complexity of the oral reading situation and the severity of stuttering. *Journal of Speech Disorders, 5*, 5-14.

Hammerfald, K., Eberle, C., Grau, M., Kinsperger, A., Zimmermann, A., Ehlert, U., et al. (2006). Persistent effects of cognitive-behavioral stress management on cortisol

responses to acute stress in healthy subjects - a randomized controlled trial. *Psychoneuroendocrinology, 31*(3), 333-339.

Hanson, B., Gronhovd, K., & Rice, P. (1981). A shortened version of the Southern Illinois University speech situation checklist for the identification of speech-related anxiety. *Journal of Fluency Disorders, 6*(4), 351-360.

Heimburg, R. G. & Becker, R. E. (2002). *Cognitive-Behavioral Group Therapy for Social Phobia.* New York, NY: The Guilford Press.

Iverach, L., O'Brian, S., Jones, M., Block, S., Lincoln, M., Harrison, E., et al. (2009). Prevalence of anxiety disorders among adults seeking speech therapy for stuttering. *Journal of Anxiety Disorders, 23*(7), 928-934.

James, S. E., Brumfitt, S. M., & Cudd, P. A. (1999). Communicating by telephone: Views of a group of people with stuttering impairment. *Journal of Fluency Disorders, 24*(4), 299-317.

Janssen, P., & Kraaimaat, F. (1980). Disfluency and anxiety in stuttering and non-stuttering adolescents. *Behavioral Analysis and Modification, 4*, 116–126.

Jezer, M. (1997). *Stuttering: a life bound up in words* (1st ed.). New York: Basic Books.

Johnson, W. (1934). Stutterers' attitudes toward stuttering. *Journal of Abnormal and Social Psychology, 29*(1), 32-44.

Johnson, W., Larson, R.P., & Knott, J.R. (1937). Studies in the psychology of stuttering: VI. The role of cues representative of stuttering moments during oral reading. *Journal of Speech Disorders, 2*, 101-104.

Johnson, W. (1942). A study of the onset and development of stuttering. *Journal of Speech and Hearing Disorders, 7*(3), 251.

Jones, M., Gebski, V., Onslow, M., & Packman, A. (2002). Statistical power in stuttering research: a tutorial. *Journal of Speech, Language, and Hearing Research, 45*(2), 243.

Kalinowski, J., Stuart, A., Wamsley, L., & Rastatter, M. P. (1999). Effects of monitoring condition and frequency-altered feedback on stuttering frequency. *Journal of Speech, Language, and Hearing Research, 42*(6), 1347-1354.

Kaplan, R., Anderson, J., & Ganiats, T. (1993). The Quality of Well-being Scale: rationale for a single quality of life index. *Quality of life assessment: key issues in the 1990s*, 65.

Kehoe, T. D. (1998). *Stuttering: science, therapy & practice: the most complete book about stuttering* (New ed.). Boulder, CO: Casa Futura Technologies.

Kirschbaum, C., & Hellhammer, D. (1989). Salivary cortisol in psychobiological research: an overview. *Neuropsychobiology, 22*(3), 150-169.

Klein, J. F., & Hood, S. B. (2004). The impact of stuttering on employment opportunities and job performance. *Journal of Fluency Disorders, 29*(4), 255-273.

Klimes-Dougan, B., Hastings, P. D., Granger, D. A., Usher, B. A., & Zahn-Waxler, C. (2001). Adrenocortical activity in at-risk and normally developing adolescents: Individual differences in salivary cortisol basal levels, diurnal variation, and responses to social challenges. *Development and Psychopathology, 13*(3), 695-719.

Klompas, M., & Ross, E. (2004). Life experiences of people who stutter, and the perceived impact of stuttering on quality of life: personal accounts of South African individuals. *Journal of Fluency Disorders, 29*(4), 275-305.

Knower, F. H. (1938). A study of speech attitudes and adjustments. *Communication Monographs*, 5(1), 130-203.

Kraaimaat, F., Janssen, P., & Brutten, G. (1988). The relationship between stutterers' cognitive and autonomic anxiety and therapy outcome. *Journal of Fluency Disorders, 13*(2), 107-113.

Kraaimaat, F., Janssen, P., & Van Dam-Baggen, R. (1991). Social anxiety and stuttering. *Perceptual and Motor Skills, 72*(3 Pt 1), 766.

Kraaimaat, F. W., Vanryckeghem, M., & van Dam-Baggen, R. (2002). Stuttering and social anxiety. *Journal of Fluency Disorders, 27*(4), 319-331.

Ladouceur, R., Cote, C., Leblond, G., & Bouchard, L. (1982). Evaluation of regulated-breathing method and awareness training in the treatment of stuttering. *Journal of speech and hearing disorders, 47*(4), 422.

Leith, W. R., & Timmons, J. L. (1983a). The stutterer's reaction to the telephone as a speaking situation. *Journal of Fluency Disorders, 8*(3), 233-243.

Leith, W. R., & Timmons, J. L. (1983b). The use of the Psychological Stress Evaluator with stutterers. *Journal of Fluency Disorders, 8*(3), 207-213.

Lerman, J., & Shames, G. (1965). The effect of situational difficulty on stuttering. *Journal of Speech and Hearing Research, 8*(3), 271.

Levine, A., Zagoory-Sharon, O., Feldman, R., Lewis, J. G., & Weller, A. (2007). Measuring cortisol in human psychobiological studies. *Physiology & Behavior, 90*(1), 43-53.

Lewis, J. (2006). Steroid analysis in saliva: an overview. *Clinical Biochemist Reviews, 27*(3), 139.

Lewis, J. (2010, unpublished data). *Saliva cortisol normal day curves*. Canterbury Health Laboratories, Christchurch.

Lincoln, M., Onslow, M., & Menzies, R. (1996). Beliefs about stuttering and anxiety: Research and clinical implications. *Australian Journal of Human Communication Disorders, 24*, 3-10.

Luecken, L. (2000). Parental caring and loss during childhood and adult cortisol responses to stress. *Psychology & Health, 15*(6), 841-851.

Mahr, G. C., & Torosian, T. (1999). Anxiety and Social Phobia in Stuttering. *Journal of Fluency Disorders, 24*(2), 119-126.

Marks, I. M. (1987). *Fears, phobias, and rituals: panic, anxiety, and their disorders*. New York: Oxford University Press.

Martin, R., & Haroldson, S. (1988). An experimental increase in stuttering frequency. *Journal of Speech and Hearing Research, 31*(2), 272.

McCroskey, J. (1978). Validity of the PRCA as an index of oral communication apprehension. *Communication Monographs, 45*(3), 192-203.

McCroskey, J. (1992). Reliability and validity of the willingness to communicate scale. *Communication Quarterly, 40*(1), 16-25.

McCroskey, J., & Beatty, M. (1986). Oral communication apprehension. *Shyness: Perspectives on research and treatment*, 279-293.

McCroskey, J., Beatty, M., Kearney, P., & Plax, T. (1985). The content validity of the PRCA-24 as a measure of communication apprehension across communication contexts. *Communication Quarterly, 33*(3), 165-173.

McCroskey, J., & McCroskey, L. (1988). Self-report as an approach to measuring communication competence. *Communication Research Reports, 5*(2), 108-113.

McCroskey, J., & Richmond, V. (1982). Communication apprehension and shyness: Conceptual and operational distinctions. *Communication Studies, 33*(3), 458-468.

McCroskey, J. C. (1978). Validity of the PRCA as an index of oral communication apprehension. *Communication Monographs, 45*(3), 192-203.

McEwen, B. (1999). Stress and hippocampal plasticity. *Annual Review of Neuroscience, 22*.

Melamed, S., Ugarten, U., Shirom, A., Kahana, L., Lerman, Y., & Froom, P. (1999). Chronic burnout, somatic arousal and elevated salivary cortisol levels. *J Psychosom Res, 46*(6), 591-598.

Menzies, R., Onslow, M., & Packman, A. (1999). Anxiety and stuttering: Exploring a complex relationship. *American Journal of Speech-Language Pathology, 8*(1), 3.

Messenger, M., Onslow, M., Packman, A., & Menzies, R. (2004). Social anxiety in stuttering: measuring negative social expectancies. *Journal of Fluency Disorders, 29*(3), 201-212.

Miller, S., & Watson, B. C. (1992). The relationship between communication attitude, anxiety, and depression in stutterers and nonstutterers. *Journal of Speech & Hearing Research, 35*(4), 789-798.

Minium, E. (1978). Statistical Reasoning in Psychology and Education (2nd ed.). New York: John Wiley & Sons.

Mulcahy, K., Hennessey, N., Beilby, J., & Byrnes, M. (2008). Social anxiety and the severity and typography of stuttering in adolescents. *Journal of Fluency Disorders, 33*(4), 306-319.

Myers, J., Weissman, M., Tischler, G., Holzer, C., Leaf, P., Orvaschel, H., et al. (1984). Six-month prevalence of psychiatric disorders in three communities: 1980 to 1982. *Archives of General Psychiatry, 41*(10), 959.

Nicolson, N. (2004). Childhood parental loss and cortisol levels in adult men. *Psychoneuroendocrinology, 29*(8), 1012-1018.

O'Brian, S., Carey, B., Onslow, M., Packman, A., & Cream, A. (2009). Manual for the Camperdown program for adults who stutter. *ASRC*, http://sydney.edu.au/health_sciences/asrc/docs/camperdown_manual.pdf.

O'Brian, S., Onslow, M., Cream, A., & Packman, A. (2003). The Camperdown Program: Outcomes of a new prolonged-speech treatment model. *Journal of Speech, Language, and Hearing Research, 46*(4), 933.

Ochsenkühn, C., Thiel, M. M., & Ewerbeck, C. (2010). *Stottern bei Kindern und Jugendlichen: Bausteine einer mehrdimensionalen Therapie* (Vol. 2nd). Berlin, Heidelberg: Springer Verlag.

Onslow, M. (Ed.). (1996). *Behavioral management of stuttering*. San Diego: Singular Pub. Group.

Onslow, M., Menzies, R., & Packman, A. (2000). Anxiety and the treatment of stuttering. *American Journal of Speech-Language Pathology, 9*(1), 91.

Ormond, T. (1981, unpublished). *A study of the overt speech behaviours of stammerers whilst talking to fluent and nonfluent speakers on the telephone*. Thesis. Christchurch.

Packman, A., & Onslow, M. (1998). The behavioral data language of stuttering. *Treatment efficacy for stuttering: A search for empirical bases*, 27–50.

Perkins, W., Kent, R., & Curlee, R. (1991). A theory of neuropsycholinguistic function in stuttering. *Journal of Speech and Hearing Research, 34*(4), 734.

Perkins, W. H. (2001). *Tongue wars: recovery from stammering* (Rev. ed.). [Reno, Nev.]: Athens Press.

Peters, H. F., & Hulstijn, W. (1984). Stuttering and anxiety: The difference between stutterers and nonstutterers in verbal apprehension and physiologic arousal during the anticipation of speech and non-speech tasks. *Journal of Fluency Disorders, 9*(1), 67-84.

Phaal, B. (2007). *An examination of anxiety and communication apprehension in preschool children who stutter: a thesis submitted in partial fulfilment of the requirements for the degree of Master of Speech and Language Therapy in the Department of Communication Disorders.* Thesis (MLST), University of Canterbury, 2007. Retrieved from http://hdl.handle.net/10092/1490

Porter, H. V. K. (1939). Studies in the psychology of stuttering. XIV. Stuttering phenomena in relation to size and personnel of audience. *Journal of Speech Disorders, 4*, 323-333.

Pruessner, J., Baldwin, M., Dedovic, K., Renwick, R., Mahani, N., Lord, C., et al. (2005). Self-esteem, locus of control, hippocampal volume, and cortisol regulation in young and old adulthood. *Neuroimage, 28*(4), 815-826.

Rami, M. K., Kalinowski, J., Stuart, A., & Rastatter, M. P. (2003). Self-Perceptions of speech language pathologists-in-training before and after pseudostuttering experiences on the telephone. *Disability and Rehabilitation: An International, Multidisciplinary Journal, 25*(9), 491-496.

Resick, P. A., Wendiggensen, P., Ames, S., & Meyer, V. (1978). Systematic slowed speech: A new treatment for stuttering. *Behaviour Research and Therapy, 16*(3), 161-167.

Riley, G. (1972). A stuttering severity instrument for children and adults. *Journal of Speech and Hearing Disorders, 37*(3), 314.

Robb, M. P. (2010). *INTRO: a guide to communication sciences and disorders*. San Diego: Plural Pub.

Rosenbaum, A., Schatzberg, A., Jost, F., Cross, P., Wells, L., Jiang, N., et al. (1983). Urinary free cortisol levels in anxiety. *Psychosomatics, 24*(9), 835.

Schalling, D., Chronholm, B., Asberg, M., & Espmark, S. (1973). Ratings of psychic and somatic anxiety indicants: Interrater reliability and relations to personaliy variables. *Acta Psychiatirca Scandinavia*, 49, 352-368.

Schiefelbein, V., & Susman, E. (2006). Cortisol levels and longitudinal cortisol change as predictors of anxiety in adolescents. *The Journal of Early Adolescence, 26*(4), 397.

Sheehan, D. (Ed.). (1983). *The Anxiety disease*. New York: Scribner.

Sheehan, J. (1953). Theory and treatment of stuttering as an approach-avoidance conflict. *The Journal of Psychology, 36*(1), 27-49.

Sheehan, J. (1958). Conflict theory of stuttering. In J.Eisenson (Ed.), *Stuttering: A symposium* (pp. 121-166). New York: Harper & Row.

Sheehan, J. G. (1970). *Stuttering : research and therapy*. New York: Harper & Row.

Shumak, I. (1955). A speech situation rating sheet for stutterers. *Stuttering in children and adults: Thirty years of research at the University of Iowa*, 341–347.

Siegel, G. M., & Haugen, D. (1964). Audience size and variations in stuttering behavior. *Journal of Speech & Hearing Research, 7*(4), 381-388.

Silverman, F. H. (1997). Telecommunication relay services: An option for stutterers. *Journal of Fluency Disorders, 22*(1), 63-64.

Spielberger, C., Gorsuch, R., & Edward, L. (1970). *STAI manual for the State-Trait Anxiety Inventory (" self-evaluation questionnaire")*: Consulting Psychologists Press.

Spielberger, G. (1983). CD Spielberger, RL Gorsuch, R. Lushene, PR Vagg and GA Jacobs, Manual for the state-trait anxiety inventory. *Mind Garden, Menlo Park, CA*.

Starkweather, C. W., Armson, J.M., & Amster, B.J. (1987). An approach to the study of motor speech mechanisms in stuttering. In L. Rustin, H. Purser & D. Rowley (Eds.), *Progress in the treatment of fluency disorders*. London: Taylor and Francis.

Starkweather, C. W., & Givens-Ackerman, J. (1997). *Stuttering*. Austin, Tex.: PRO-ED.

Steer, M. D., & Johnson, W. (1936). An objective study of the relationship between psychological factors and the severity of stuttering. *The Journal of Abnormal and Social Psychology, 31*(1), 36-46.

Stein, M. B., Baird, A., & Walker, J. R. (1996). Social phobia in adults with stuttering. *The American Journal of Psychiatry, 153*(2), 278-280.

Svab, L., Gross, J., & Langova, J. (1972). Stuttering and social isolation: Effect of social isolation with different levels of monitoring on stuttering frequency: A pilot study. *Journal of Nervous and Mental Disease, 155*(1), 1-5.

Teesson, K., Packman, A., & Onslow, M. (2003). The Lidcombe behavioral data language of stuttering. *Journal of Speech, Language, and Hearing Research, 46*(4), 1009.

Thomas, K. (2007). *Is There an Association between Anxiety and Stuttering in Adults? a thesis submitted in partial fulfilment of the requirements for the degree of Master of Arts at the Graudate School.* Thesis: (MA), The University of Maine.

Turner, S., Beidel, D., Cooley, M., Woody, S., & Messer, S. (1994). A multicomponent behavioral treatment for social phobia: Social effectiveness therapy. *Behaviour Research and Therapy, 32*(4), 381-390.

Turner, S., Beidel, D., Dancu, C., & Keys, D. (1986). Psychopathology of social phobia and comparison to avoidant personality disorder. *Journal of Abnormal Psychology, 95*(4), 389-394.

Van Riper, C., & Hull, C. (1955). The quantitative measurement of the effect of certain situations on stuttering. In W. Johnson & R. R. Leutenegger (Eds.), *Stuttering in children and adults* (pp. 199-206). Minneapolis: University of Minnesota Press.

Vanryckeghem, M. (1995). The Communication Attitude Test: A concordancy investigation of stuttering and nonstuttering children and their parents. *Journal of Fluency Disorders, 20*(2), 191-203.

Vanryckeghem, M., & Brutten, G. (1996). The relationship between communication attitude and fluency failure of stuttering and nonstuttering children. *Journal of Fluency Disorders, 21*(2), 109-118.

Ward, D. (2006). *Stuttering and cluttering: frameworks for understanding and treatment*. Hove [England] ; New York: Psychology Press.

Watson, D., & Friend, R. (1969). Measurement of social-evaluative anxiety. *Journal of consulting and clinical psychology, 33*(4), 448-457.

Watson, J. (1987). Profiles of stutterers' and nonstutterers' affective, cognitive, and behavioral communication attitudes. *Journal of Fluency Disorders, 12*(6), 389-405.

Watson, J. (1988). A comparison of stutterers' and nonstutterers' affective, cognitive, and behavioral self-reports. *Journal of Speech and Hearing Research, 31*(3), 377.

Watson, J., Gregory, H., & Kistler, D. (1987). Development and evaluation of an inventory to assess adult stutterers' communication attitudes, *Journal of Fluency Disorders, 12*(6), 429-450.

Weber, C., & Smith, A. (1990). Autonomic correlates of stuttering and speech assessed in a range of experimental tasks. *Journal of Speech, Language and Hearing Research, 33*(4), 690-706.

Wendlandt, W. (2009). *Stottern im Erwachsenenalter: Grundlagenwissen und Handlungshilfen für die Therapie und Selbsthilfe*. Stuttgart: Thieme Verlag.

Wingate, M. E. (1962). Evaluation and stuttering: II. Environmental stress and critical appraisal of speech. *Journal of Speech & Hearing Disorders, 27*(3), 244-257.

Wolpe, J. (1990). *The practice of behavior therapy*: Pergamon Press New York.

Yaruss, J., & Quesal, R. (2004). Stuttering and the International Classification of Functioning, disability, and health (ICF): an update. *Journal of Communication Disorders, 37*(1), 35-52.

Yaruss, J., & Quesal, R. (2006). Overall Assessment of the Speaker's Experience of Stuttering (OASES): Documenting multiple outcomes in stuttering treatment. *Journal of Fluency Disorders, 31*(2), 90-115.

Young, M. A. (1965). Audience size, perceived situational difficulty and stuttering frequency. *Journal of Speech & Hearing Research, 8*(4), 401-407.

Young, M. A. (1985). Increasing the frequency of stuttering. *Journal of Speech & Hearing Research, 28*(2), 282-293.

Zimmerman, S., Kalinowski, J., Stuart, A., & Rastatter, M. (1997). Effect of altered auditory feedback on people who stutter during scripted telephone conversations. *Journal of Speech, Language, and Hearing Research, 40*(5), 1130-1134.

Appendix A

Human Ethics Committe Approval Letter

UNIVERSITY OF CANTERBURY
Te Whare Wānanga o Waitaha
CHRISTCHURCH NEW ZEALAND

Ref: HEC 2010/71

11 June 2010

Janine Diehl
Department of Communication Disorders
UNIVERSITY OF CANTERBURY

Dear Janine

The Human Ethics Committee advises that your research proposal "The relationship between salivary cortisol levels and self perception of speaking environments in adults who stutter" has been considered and approved.

Please note that this approval is subject to the incorporation of the amendments you have provided in your email of 9 June 2010.

Best wishes for your project.

Yours sincerely

Dr Michael Grimshaw
Chair, Human Ethics Committee

Appendix B

Participant Information Letter for AWS and AWNS participants

Participant Information Letter for Listeners (Friend, Stranger and Group)

Consent Form

Department of Communication Disorders

UNIVERSITY OF CANTERBURY
Te Whare Wānanga o Waitaha
CHRISTCHURCH NEW ZEALAND

Project Information Sheet

PARTICIPANT INFORMATION

Project Information

You are invited to participate in the research project "The relationship between salivary cortisol levels and self-perception of anxiety in adults who stutter across various speaking situations".

The aim of this project is to investigate whether persons who stutter have different anxiety levels in various speaking situations than persons who do not stutter.

Your participation in this project will involve five 45-minute sessions occurring over a one-week period. All sessions will take place in the Department of Communication Disorders. During these sessions you will complete two questionnaires: one to determine your self-perceived severity of stuttering in different every day communication situations and the second one to examine your perceived anxiety levels in four specific speaking situations. In addition, you will also be asked to provide saliva samples during each of these sessions as a measure of anxiety. The samples will be collected by chewing on a cotton roll for approximately 30-60 seconds and stored for later analysis.

The first five sessions will occur during five consecutive days. During the first session you will only provide a saliva sample. At the conclusion of this session, you will be "prewarned" for a speaking situation to complete during the next session (day). During the next session you will first provide a saliva sample and then complete the speaking task. The speaking task will last approximately 10 minutes. Thirty minutes following completion of the speaking task a second saliva sample will be collected. At the conclusion of the session you will again be "prewarned" of the speaking task to be completed during the next session. The same data collection will occur in this session and the remaining two sessions. The four speaking situations will be (1) speaking face-to-face with a friend, (2) speaking face-to-face with a stranger, (3) speaking in front of a group of five people, and (4) speaking to a stranger on the telephone. These speaking situations may contribute to you experiencing mental stress. If you feel uncomfortable, in any way, you will have both the option of talking with the researcher and her supervisor about any concerns or discontinuing participation and the recording will be destroyed. The researcher, who is a Speech Language Therapist, will be available should any concerns arise following participation. Exactly one week after conclusion of the fifth session you will be required to return to the Department of Communication Disorders to provide a final saliva sample.

If you are interested in the results of this study, you are welcome to inspect your data at the end of the project. You may withdraw from the project at any time, including withdrawal of any information that you have provided. The results of the project may be published, however you may be assured of the complete confidentiality of data gathered in this investigation; the identity of participants will not be made public. The researcher and her advisors will be the only authorised persons to have access to the data.

The project is being carried out as a requirement for a Masters of Speech and Language Therapy by Janine Diehl, under the supervision of Professor Michael Robb, who can be contacted at the University of Canterbury on 364 3296. They will be pleased to discuss any concerns you may have about participation in the project. The project has been reviewed and approved by the University of Canterbury Human Ethics Committee.

Sincerely,

Janine Diehl (BLST)
Master of Speech and Language Therapy Student
Ph: 33411500 extn 52198
Mob: 021 713008
Email: jdd45@uclive.ac.nz

Professor Michael Robb
Department of Communication Disorders
Ph: 364 2987 extn 7077
Email:michael.robb@canterbury.ac.nz

Department of Communication Disorders

UNIVERSITY OF CANTERBURY
Te Whare Wānanga o Waitaha
CHRISTCHURCH NEW ZEALAND

Project Information Sheet

INFORMATION FOR FRIEND AND STRANGERS

Project Information

You are invited to participate in the research project "The relationship between salivary cortisol levels and self-perception of anxiety in adults who stutter across various speaking situations".

The aim of this project is to investigate whether persons who stutter have different anxiety levels in various speaking situations than persons who do not stutter.

Your participation in this project will involve emerging in a 10 minutes conversation with an individual who does or does not stutter. During the conversational activity, the individual will tell you about their current occupation or job, and about their own interests and hobbies. You are more in the role of a listener, however, feel free to ask questions.

The project is being carried out as a requirement for a Masters of Speech and Language Therapy by Janine Diehl, under the supervision of Professor Michael Robb, who can be contacted at the University of Canterbury on 364 3296. They will be pleased to discuss any concerns you may have about participation in the project. The project has been reviewed and approved by the University of Canterbury Human Ethics Committee.

Sincerely,

Janine Diehl (BLST)
Master of Speech and Language Therapy Student
Ph: 33411500 extn 52198
Mob: 021 713008
Email: jdd45@uclive.ac.nz

Professor Michael Robb
Department of Communication Disorders
Ph: 364 2987 extn 7077
Email: michael.robb@canterbury.ac.nz

Department of Communication Disorders

Janine Diehl
Department of Communication Disorders
University of Canterbury
Private Bag 4800
Christchurch
10 May 2010

Consent Form

"The relationship between salivary cortisol levels and self-perception of anxiety in adults who stutter across various speaking situations".

I have read and understood the description of the above-named project. On this basis, I agree to my participation in the project, and I consent to publication of the results of the project with the understanding that confidentiality will be preserved.

I understand that I may withdraw from the project at any time, including withdrawal of any information that I have provided.

PARTICIPANT'S NAME (please print)…….....

PARTICIPANT'S CONTACT DETAILS (full address and phone number)…….....

.....

Signature:

Date:

University of Canterbury Private Bag 4800, Christchurch 8020, New Zealand.
Tel: +64 3 364-2987 x7077, Fax: +64 3 364 2260
www.cmds.canterbury.ac.nz

Appendix C

Interview Sheets for AWS participants

Interview Sheets for AWNS participants

Department of Communication Disorders

UNIVERSITY OF CANTERBURY
Te Whare Wānanga o Waitaha
CHRISTCHURCH NEW ZEALAND

INFORMATION ABOUT THE PARTICIPANTS (AWS Group)

- INTERVIEW -

General Questions about the person

Name: _____

Sex:

Male	Female
☐	☐

Age: _____

Age Group:

18 - 21	21 - 24	24 - 27	24 - 35	35 – 50	50 - 60	60-70
☐	☐	☐	☐	☐	☐	☐

Current Occupation/Job: _____

Questions about Stuttering

Onset of Stuttering: _____

Treatment Status:

Yes	No
☐	☐

University of Canterbury Private Bag 4800, Christchurch 8020, New Zealand.
Tel: +64 3 364-2987 x7077, Fax: +64 3 364 2260
www.cmds.canterbury.ac.nz

Describe your type of Stuttering Therapy (type e.g., Fluency Shaping, Stuttermodification etc.):

_____

_____

Describe your Stuttering (e.g., word repetitions, prolongations, blocks etc.):

_____

_____

Do you feel anxious when you have to speak or not?

_____

On a scale from 1 to 10, if you have to rate your stuttering severity: ranging from 1 meaning no stuttering and 10 being severe stuttering, where would you rate yourself?

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)

Thank you very much for participating!

Department of Communication Disorders

UNIVERSITY OF CANTERBURY
Te Whare Wānanga o Waitaha
CHRISTCHURCH NEW ZEALAND

INFORMATION ABOUT THE CONTROL GROUP (AWNS Group)

- INTERVIEW -

General Questions about the person

Name: _____

Sex:

Male	Female
☐	☐

Age: _____

Age Group:

18 - 21	21 - 24	24 - 27	24 - 35	35 – 50	50 - 60	60-70
☐	☐	☐	☐	☐	☐	☐

Current Occupation/Job: _____

Thank you very much!!!!

University of Canterbury Private Bag 4800, Christchurch 8020, New Zealand.
Tel: +64 3 364-2987 x7077, Fax: +64 3 364 2260
www.cmds.canterbury.ac.nz

Appendix D

Communication Situation Scale (CSS) used for the present study (Green, 1999)

Overall Assessment of the Speaker‘s Experience of Stuttering (OASES) used for the present study (Yaruss & Quesal, 2006)

Department of Communication Disorders

UNIVERSITY OF CANTERBURY
Te Whare Wānanga o Waitaha
CHRISTCHURCH NEW ZEALAND

Participants Initials:
Date of Data Collection:

Adapted form of the Communication Situation Scale (Green, 1999)

Instructions: Rate your perceived severity of stuttering on a scale from 1-4 in every-day communication situations by making a cross in the according box.
Rating scale: 1 = no stuttering
2 = mild
3 =moderate
4 = severe

Questionnaire:

Speaking situations	**Stuttering severity**			
	1= no stuttering	2= mild	3= moderate	4= severe
1. *Talking with a person you know well*				
2. *Speaking to yourself*				
3. *Phoning a stranger*				
4. *Phoning an acquaintance*				
5. *Ordering a ticket*				
6. *Talking with a shop assistant about prices and articles*				
7. *Talking with a boss*				
8. *Talking at the dinner table at home*				
9. *Talking with colleagues*				

	1= no stuttering	2= mild	3= moderate	4= severe
10. *Talking with a stranger, when others are listening*				
11. *Talking to an audience of unknown people*				
12. *Talking to an audience of known people*				
13. *Asking a stranger about the time*				
14. *All types of speaking situations*				

Thank you very much!

University of Canterbury Private Bag 4800, Christchurch 8020, New Zealand.
Tel: +64 3 364-2987 x7077, Fax: +64 3 364 2260
www.cmds.canterbury.ac.nz

Quite a comprehensive Assessment.
- to add to file

Overall Assessment of the Speaker's Experience of Stuttering (OASES)

Name: _____ Age: _____ Sex: M F Date: _____

Instructions. This test consists of four sections that examine different aspects of your experience of stuttering. Please complete each item by circling the appropriate number. If an item does not apply to you, leave it blank and move on to the next item.

Section I: General Information

A. General information about your speech.	Always	Frequently	Sometimes	Rarely	Never
1. How often are you able to speak fluently?	1	2	3	4	5
2. How often does your speech *sound* "natural" to you (i.e., like the speech of other people)?	1	2	3	4	5
3. How consistently are you able to maintain fluency from day to day?	1	2	3	4	5
4. How often do you use techniques, strategies, or tools you learned in speech therapy?	1	2	3	4	5
5. How often do you say exactly what you want to say even if you think you might stutter?	1	2	3	4	5

B. How <u>knowledgeable</u> are you about...?	Extremely	Very	Somewhat	A Little	Not At All
1. Stuttering in general	1	2	3	4	5
2. Factors that affect stuttering	1	2	3	4	5
3. What happens with your speech when you stutter	1	2	3	4	5
4. Treatment options for people who stutter	1	2	3	4	5
5. Self-help or support groups for people who stutter	1	2	3	4	5

C. Overall, how do you <u>feel</u> about...?	Very Positively	Somewhat Positively	Neutral	Somewhat Negatively	Very Negatively
1. Your speaking ability	1	2	3	4	5
2. Your ability to communicate (i.e., to get your message across regardless of your fluency)	1	2	3	4	5
3. The way you sound when you speak	1	2	3	4	5
4. Techniques for speaking fluently (e.g., techniques learned in therapy)	1	2	3	4	5
5. Your ability to **use** techniques you learned in speech therapy	1	2	3	4	5
6. Being a person who stutters	1	2	3	4	5
7. The speech therapy program you attended most recently	1	2	3	4	5
8. Being identified by other people as a stutterer/person who stutters	1	2	3	4	5
9. Variations in your speech fluency in different situations	1	2	3	4	5
10. Self-help or support groups for people who stutter	1	2	3	4	5

Section II: Your Reactions to Stuttering

A. When you think about your stuttering, how often do you feel...? *(Note: please complete both columns in this section)*											
	Never	Rarely	Sometimes	Often	Always		Never	Rarely	Sometimes	Often	Always
1. helpless	1	2	3	4	5	6. depressed	1	2	3	4	5
2. angry	1	2	3	4	5	7. defensive	1	2	3	4	5
3. ashamed	1	2	3	4	5	8. embarrassed	1	2	3	4	5
4. lonely	1	2	3	4	5	9. guilty	1	2	3	4	5
5. anxious	1	2	3	4	5	10. frustrated	1	2	3	4	5

B. How often do you...?	Never	Rarely	Sometimes	Frequently	Always
1. Experience physical tension when stuttering	1	2	3	4	5
2. Experience physical tension when speaking fluently	1	2	3	4	5
3. Exhibit eye blinks, facial grimaces, arm movements, etc. when stuttering	1	2	3	4	5
4. Break eye contact or avoid looking at your listener	1	2	3	4	5
5. Avoid speaking in certain situations or to certain people	1	2	3	4	5
6. Leave a situation because you think you might stutter	1	2	3	4	5
7. Not say what you want to say (e.g., avoid or substitute words, refuse to answer questions, order something you do not want because it is easier to say)	1	2	3	4	5
8. Use filler words or starters (e.g., "um," clearing throat), or change something about your speech (e.g., use an accent) to be more fluent. *(Note: this does not refer to techniques you may have learned in therapy.)*	1	2	3	4	5
9. Experience a period of increased stuttering just after you stutter on a word	1	2	3	4	5
10. Let somebody else speak for you	1	2	3	4	5

C. To what extent do you agree or disagree with the following statements.	Strongly Disagree	Somewhat Disagree	Neutral	Somewhat Agree	Strongly Agree
1. I think about my stuttering nearly all the time.	1	2	3	4	5
2. People's opinions about me are based primarily on how I speak.	1	2	3	4	5
3. If I did not stutter, I would be better able to achieve my goals in life.	1	2	3	4	5
4. I do not want people to know that I stutter.	1	2	3	4	5
5. When I am stuttering, there is nothing I can do about it.	1	2	3	4	5
6. People should do everything they can do to keep themselves from stuttering.	1	2	3	4	5
7. People who stutter should not take jobs that require a lot of speaking.	1	2	3	4	5
8. I do not speak as well as most other people.	1	2	3	4	5
9. I cannot accept the fact that I stutter.	1	2	3	4	5
10. I do not have confidence in my abilities as a speaker.	1	2	3	4	5

Section III: Communication in Daily Situations

(In this section, indicate how much difficulty you experience in these situations, not how fluent you are.)

A. How *difficult* is it for you to communicate in the following general situations?	Not at all Difficult	Not Very Difficult	Somewhat Difficult	Very Difficult	Extremely Difficult
1. Talking with another person "one-on-one"	1	2	3	4	5
2. Talking while under time pressure	1	2	3	4	5
3. Talking in front of a small group of people	1	2	3	4	5
4. Talking in front of a large group of people	1	2	3	4	5
5. Talking with people you *do* know well (e.g., friends)	1	2	3	4	5
6. Talking with people you *do not* know well (e.g., strangers)	1	2	3	4	5
7. Talking on the telephone in general	1	2	3	4	5
8. Initiating conversations with other people (e.g., introducing yourself)	1	2	3	4	5
9. Continuing to speak regardless of how your listener responds to you	1	2	3	4	5
10. Standing up for yourself verbally (e.g., defending your opinion, challenging someone who cuts in line in front of you)	1	2	3	4	5

B. How *difficult* is it for you to communicate in the following situations at work?	Not at all Difficult	Not Very Difficult	Somewhat Difficult	Very Difficult	Extremely Difficult
1. Using the telephone at work	1	2	3	4	5
2. Giving oral presentations or speaking in front of other people at work	1	2	3	4	5
3. Talking with co-workers or other people you work with (e.g., participating in meetings)	1	2	3	4	5
4. Talking with customers or clients	1	2	3	4	5
5. Talking with your supervisor or boss	1	2	3	4	5

C. How *difficult* is it for you to communicate in the following social situations?	Not at all Difficult	Not Very Difficult	Somewhat Difficult	Very Difficult	Extremely Difficult
1. Participating in social events (e.g., making "small talk" at parties)	1	2	3	4	5
2. Telling stories or jokes	1	2	3	4	5
3. Asking for information (e.g., asking for directions or other people's opinions)	1	2	3	4	5
4. Ordering food in a restaurant	1	2	3	4	5
5. Ordering food at a drive-thru	1	2	3	4	5

D. How *difficult* is it for you to communicate in the following situations at home?	Not at all Difficult	Not Very Difficult	Somewhat Difficult	Very Difficult	Extremely Difficult
1. Using the telephone at home	1	2	3	4	5
2. Talking to your spouse / significant other	1	2	3	4	5
3. Talking to your children	1	2	3	4	5
4. Talking to members of your extended family	1	2	3	4	5
5. Taking part in family discussions	1	2	3	4	5

Section IV: Quality of Life

A. How much is your overall *quality of life* negatively affected by...?	Stuttering *negatively affects* my quality of life... Not At All	A Little	Some	A Lot	Completely
1. Your stuttering	1	2	3	4	5
2. Your reactions to your stuttering	1	2	3	4	5
3. Other people's reactions to your stuttering	1	2	3	4	5

B. Overall, how much does stuttering *interfere with your satisfaction* with communication...?	Stuttering *interferes* with my communication satisfaction... Not At All	A Little	Some	A Lot	Completely
1. In general	1	2	3	4	5
2. At work	1	2	3	4	5
3. In social situations	1	2	3	4	5
4. At home	1	2	3	4	5

C. Overall, how much does stuttering *interfere* with your...?	Stuttering *interferes* with my relationships... Not At All	A Little	Some	A Lot	Completely
1. Relationships with family	1	2	3	4	5
2. Relationships with friends	1	2	3	4	5
3. Relationships with other people	1	2	3	4	5
4. Intimate relationships	1	2	3	4	5
5. Ability to function in society	1	2	3	4	5

D. Overall, how much does stuttering *interfere* with your...?	Stuttering *interferes* with my career... Not At All	A Little	Some	A Lot	Completely
1. Ability to do your job	1	2	3	4	5
2. Satisfaction with your job	1	2	3	4	5
3. Ability to advance in your career	1	2	3	4	5
4. Educational opportunities	1	2	3	4	5
5. Ability to earn as much as you feel you should	1	2	3	4	5

E. Overall, how much does stuttering *interfere with* your...?	Stuttering *interferes* with my personal life... Not At All	A Little	Some	A Lot	Completely
1. Sense of self-worth or self-esteem	1	2	3	4	5
2. Overall outlook on life	1	2	3	4	5
3. Confidence in yourself	1	2	3	4	5
4. Enthusiasm for life	1	2	3	4	5
5. Overall health and physical well-being	1	2	3	4	5
6. Overall stamina or energy level	1	2	3	4	5
7. Sense of control over your life	1	2	3	4	5
8. Spiritual well-being	1	2	3	4	5

Overall Assessment of the Speaker's Experience of Stuttering (OASES)

Scoring Summary

Instructions. Calculate **Impact Scores** for each of the 4 sections on the OASES by (a) totaling the number of points in each section and (b) counting the number of items completed in each section. Multiply the number of items completed by 5 to obtain the total points *possible* for each section. The impact score for each section is equal to 100 times the points in each section divided by the total points possible for that section. (Impact scores will always range between 20 and 100.) Determine **Impact Ratings** for each section based on the impact scores in the table at the bottom of the page.

Name: _____ Age: _____ Sex: M F Date: _____

Section I: General Information (20 Items Total)

Section I Points: _____ Items Completed in Section I: _____

Section I Points Possible (Section I Items Completed × 5): _____

Section I Impact Score: _____ **Impact Rating:** _____

Section II: Reactions to Stuttering (30 Items Total)

Section II Points: _____ Items Completed in Section II: _____

Section II Points Possible (Section II Items Completed × 5): _____

Section II Impact Score: _____ **Impact Rating:** _____

Section III: Communication in Daily Situations (25 Items Total)

Section III Points: _____ Items Completed in Section III: _____

Section III Points Possible (Section III Items Completed × 5): _____

Section III Impact Score: _____ **Impact Rating:** _____

Section IV: Quality of Life (25 Items Total)

Section IV Points: _____ Items Completed in Section IV: _____

Section IV Points Possible (Section IV Items Completed × 5): _____

Section IV Impact Score: _____ **Impact Rating:** _____

TOTAL IMPACT SCORE (100 Items Total)

Total Points: _____ Total Items Completed: _____

(Total Points = Section I Points + Section II Points + Section III Points + Section IV Points)
(Total Items Completed = Section I Items Completed + Section II Items Completed + Section III Items Completed + Section IV Items Completed)

Total Points Possible (Total Items Completed × 5): _____

Total Impact Score: _____ **Impact Rating:** _____

Impact Rating	Impact Scores
Mild	20.0 – 29.9
Mild-to-Moderate	30.0 – 44.9
Moderate	45.0 - 59.9
Moderate-to-Severe	60.0 – 74.9
Severe	75.0 – 100

J. Scott Yaruss, PhD & Robert W. Quesal, PhD

Appendix E

Adapted versions of the Speaking Task Response Scale (STRS) *pre*- and *post*-sampling in four different speaking situations (Bray & James, 2009)

Department of Communication Disorders

UNIVERSITY OF CANTERBURY
Te Whare Wānanga o Waitaha
CHRISTCHURCH NEW ZEALAND

Participants Initials:

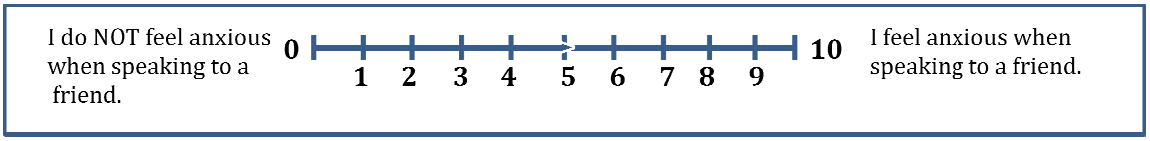
Date of Data Collection:

Speaking Task Response Scale (Bray & James, 2009) for AWS

Instructions: To complete the questionnaire please circle the number that correspond to the strength of your feelings about each question.

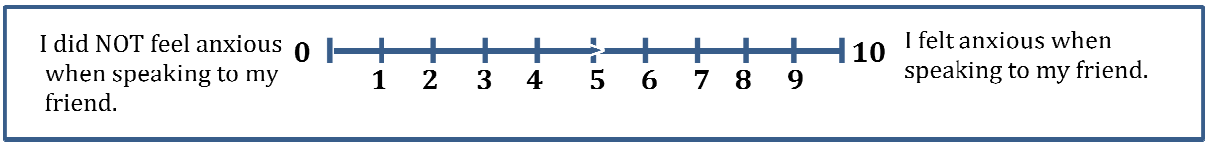
Questionnaire about speaking to a friend

Please complete this section *before* you speak with your friend.

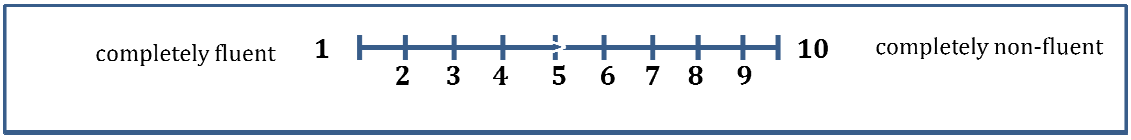


Please complete this section *after* you spoke with your friend.

How did you feel while speaking to your friend?



How would you rate your fluency while speaking to your friend?



Thank you very much!

University of Canterbury Private Bag 4800, Christchurch 8020, New Zealand.
Tel: +64 3 364-2987 x7077, Fax: +64 3 364 2260
www.cmds.canterbury.ac.nz

Department of Communication Disorders

Participants Initials:

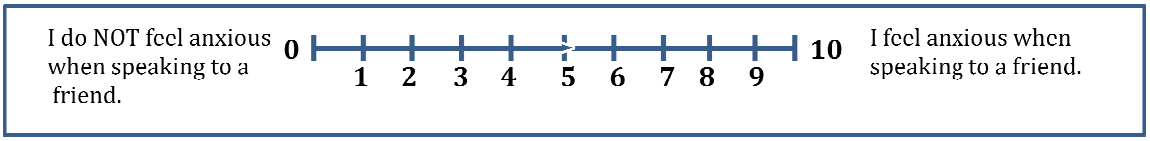
Date of Data Collection:

Speaking Task Response Scale (Bray & James, 2009) for AWNS

Instructions: To complete the questionnaire please circle the number that correspond to the strength of your feelings about each question.

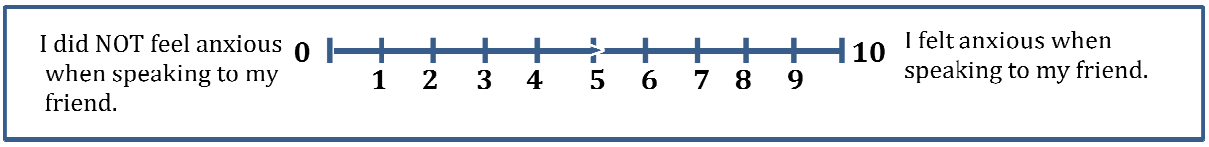
Questionnaire about speaking to a friend

Please complete this section *before* you speak with your friend.



Please complete this section *after* you spoke with your friend.

How did you feel while speaking to your friend?



Thank you very much!

University of Canterbury Private Bag 4800, Christchurch 8020, New Zealand.
Tel: +64 3 364-2987 x7077, Fax: +64 3 364 2260
www.cmds.canterbury.ac.nz

Department of Communication Disorders

Participants Initials:

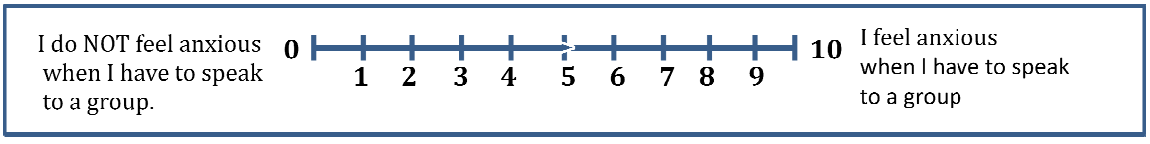
Date of Data Collection:

Speaking Task Response Scale (Bray & James, 2009) for AWS

Instructions: To complete the questionnaire please circle the number that correspond to the strength of your feelings about each question.

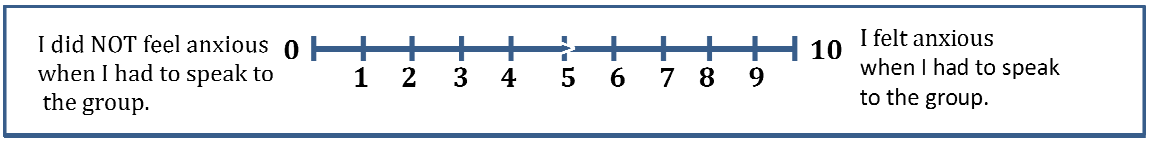
Questionnaire about speaking to a group

Please complete this section *before* you speak to the group.

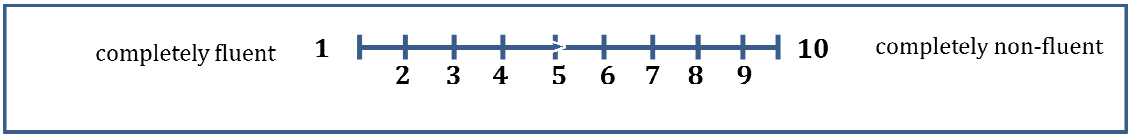


Please complete this section *after* you spoke to the group

How did you feel while speaking to the group?



How would you rate your fluency while speaking to the group?



Thank you very much!

University of Canterbury Private Bag 4800, Christchurch 8020, New Zealand.
Tel: +64 3 364-2987 x7077, Fax: +64 3 364 2260
www.cmds.canterbury.ac.nz

Department of Communication Disorders

UNIVERSITY OF CANTERBURY
Te Whare Wānanga o Waitaha
CHRISTCHURCH NEW ZEALAND

Participants Initials:

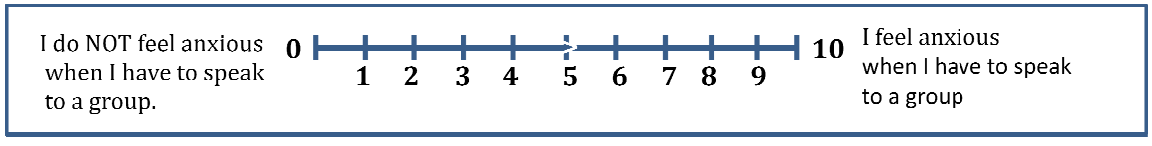
Date of Data Collection:

Speaking Task Response Scale (Bray & James, 2009) for AWNS

Instructions: To complete the questionnaire please circle the number that correspond to the strength of your feelings about each question.

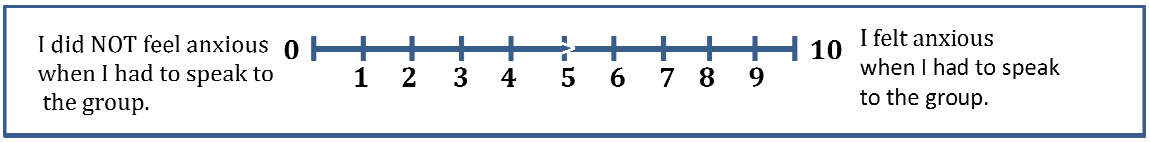
Questionnaire about speaking to a group

Please complete this section *before* you speak to the group.



Please complete this section *after* you spoke to the group

How did you feel while speaking to the group?



Thank you very much!

University of Canterbury Private Bag 4800, Christchurch 8020, New Zealand.
Tel: +64 3 364-2987 x7077, Fax: +64 3 364 2260
www.cmds.canterbury.ac.nz

Department of Communication Disorders

UNIVERSITY OF CANTERBURY
Te Whare Wānanga o Waitaha
CHRISTCHURCH NEW ZEALAND

Participants Initials:

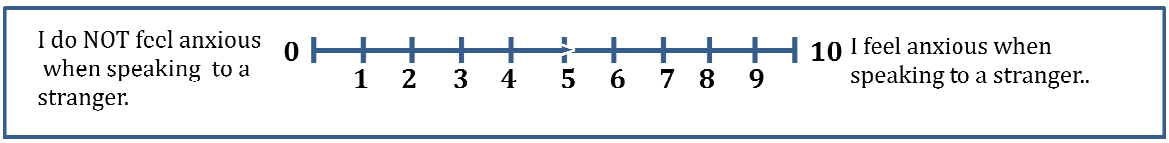
Date of Data Collection:

Speaking Task Response Scale (Bray & James, 2009) for AWS

Instructions: To complete the questionnaire please circle the number that correspond to the strength of your feelings about each question.

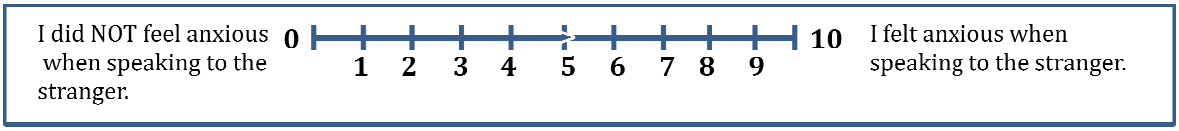
Questionnaire about speaking with a stranger

Please complete this section *before* you speak with a stranger.

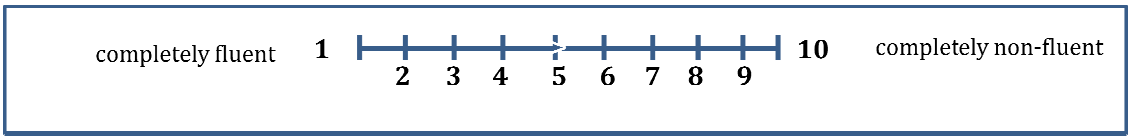


Please complete this section *after* you spoke with the stranger

How did you feel while speaking to the stranger?



How would you rate your fluency while speaking with the stranger?



Thank you very much!

University of Canterbury Private Bag 4800, Christchurch 8020, New Zealand.
Tel: +64 3 364-2987 x7077, Fax: +64 3 364 2260
www.cmds.canterbury.ac.nz

Department of Communication Disorders

UNIVERSITY OF CANTERBURY
Te Whare Wānanga o Waitaha
CHRISTCHURCH NEW ZEALAND

Participants Initials:

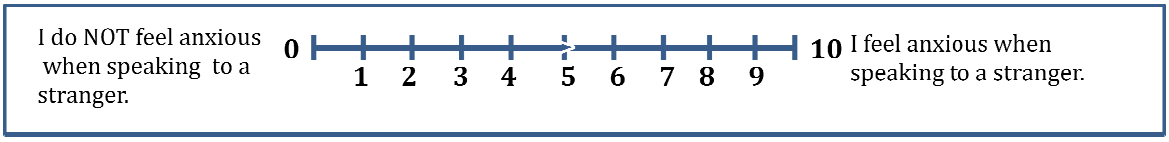
Date of Data Collection:

Speaking Task Response Scale (Bray & James, 2009) for AWNS

Instructions: To complete the questionnaire please circle the number that correspond to the strength of your feelings about each question.

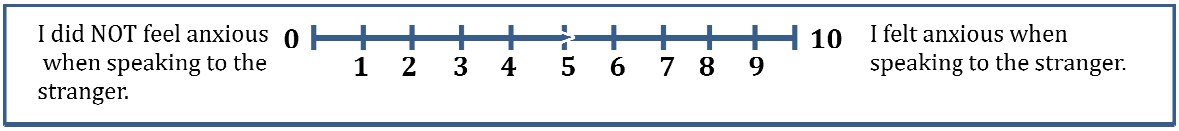
Questionnaire about speaking with a stranger

Please complete this section *before* you speak with a stranger.



Please complete this section *after* you spoke with the stranger

How did you feel while speaking to the stranger?



Thank you very much!

University of Canterbury Private Bag 4800, Christchurch 8020, New Zealand.
Tel: +64 3 364-2987 x7077, Fax: +64 3 364 2260
www.cmds.canterbury.ac.nz

Department of Communication Disorders

UNIVERSITY OF CANTERBURY
Te Whare Wānanga o Waitaha
CHRISTCHURCH NEW ZEALAND

Participants Initials:

Date of Data Collection:

Speaking Task Response Scale (Bray & James, 2009) for AWS

Instructions: To complete the questionnaire please circle the number that correspond to the strength of your feelings about each question.

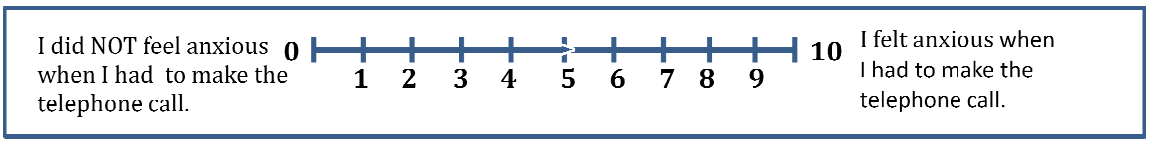
Questionnaire about speaking on the telephone

Please complete this section *before* you make your phone call.

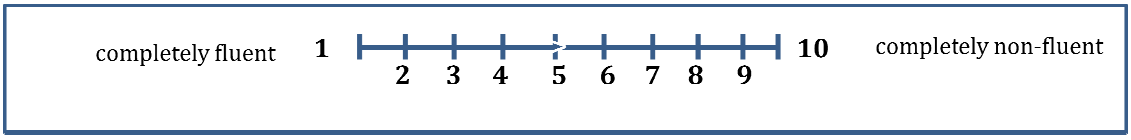
I feel NOT anxious when I have to make a telephone call.	0 1 2 3 4 5 6 7 8 9 10	I feel anxious when I have to make a telephone call.

Please complete this section *after* you made your phone call

How did you feel while speaking on the telephone?



How would you rate your fluency while making the telephone call?



Thank you very much!

University of Canterbury Private Bag 4800, Christchurch 8020, New Zealand.
Tel: +64 3 364-2987 x7077, Fax: +64 3 364 2260
www.cmds.canterbury.ac.nz

Department of Communication Disorders

UNIVERSITY OF CANTERBURY
Te Whare Wānanga o Waitaha
CHRISTCHURCH NEW ZEALAND

Participants Initials:

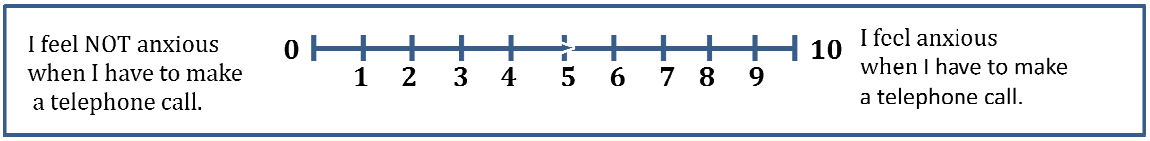
Date of Data Collection:

Speaking Task Response Scale (Bray & James, 2009) for AWNS

Instructions: To complete the questionnaire please circle the number that correspond to the strength of your feelings about each question.

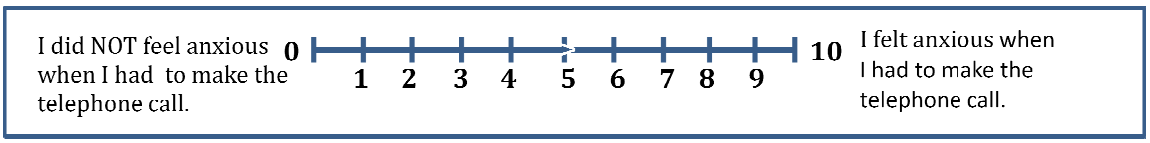
Questionnaire about speaking on the telephone

Please complete this section *before* you make your phone call.



Please complete this section *after* you made your phone call

How did you feel while speaking on the telephone?

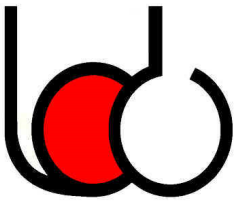


Thank you very much!

University of Canterbury Private Bag 4800, Christchurch 8020, New Zealand.
Tel: +64 3 364-2987 x7077, Fax: +64 3 364 2260
www.cmds.canterbury.ac.nz

Appendix F

Procedures for the Analysis and Determination of Cortisol (Phaal, 2007)



Procedures for the Analysis and Determination of Cortisol
(Lewis cited in Phaal, 2007; courtesy of Lewis, 2010)

Prior to performing the cortisol analyses, the salivettes were thawed and centrifuged for 10 minutes at 3000 rpm to recover the saliva. Samples from a particular participant were always analysed in the same batch to avoid between-assay variation. Saliva cortisol was measured in 96 well microtitre plates by enzyme-linked immunosorbent assay (ELISA) using a monoclonal antibody (Lewis et al., 1992). These ELISA plates (Falcon 3912 microtest III) were coated overnight at 4C with 100 µL of cortisol-thyroglobulin conjugate/well (1µg/mL) in 6M aqueous guanidine hydrochloride. The following day the plates were washed four times with a solution of phosphatebuffered saline (PBS), 0.05 M NaH2PO4, 0.15 M NaCl adjusted to pH 7.4 with 5M NaOH, containing 0.1% Tween 20 (v/v). To prevent further adsorption of protein, the plates were then "blocked" with assay buffer, PBS containing 0.1% Tween 20 (v/v) and 0.1% gelatine (w/v) for 1 hour at room temperature. After emptying the plates by inversion they were blotted dry and duplicate portions of standards or reconstituted saliva extracts were added (50 µL/well) followed by 50µL of a pre-formed complex of cortisol monoclonal antibody (1:35) and antimouse Ig-peroxidase (1:500) in assay buffer for 30 minutes at room temperature (Lewis & Elder, 2000). The plates were then washed four times and 100µL/well of substrate added. Substrate was prepared by the addition of 600mL aqueous solution containing 8.2g anhydrous sodium acetate and 3.6g citric acid to 400mL of methanol containing 270 mg of tetramethyl benzidine. Five hundred µL of 30% H_2O_2 was finally added and the substrate stored in a dark bottle at room temperature. Colour development was terminated by the addition of 100µL of 0.9M HCl per well, the absorbance read at 450nm on a

BMG Fluostar Galaxy (BMG, Technologies GmbH, Germany), and unknowns interpolated on the standard curve. To avoid evaporation 91 losses, the plates were covered during all the steps preceding the addition of substrate.

Saliva (250µL) was extracted with 1mL of dichloromethane and 500µL dried in glass tubes. The dried extract was reconstituted with 25µL of assay buffer and duplicate 50µL portions used for ELISA. A series of 7 authentic cortisol standards were prepared in assay buffer, 0, 3.5, 7.0, 14.0, 28.0, 56.0 and 280nmol/L from a stock standard of 1mg/mL in ethanol.